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TESI DI LAUREA IN COOPERAZIONE ALLO SVILUPPO

Role of Extension Services as institutional structure of governance in biomass production for energy purpose. Experiences on field in Finland and hypothesis for sustainable rural development.

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Abstract

This study focuses on the role of Extension Institution in Bio Energy as structure of governance for sustainable use of biomass in rural development.

Theoretical approach is derived from New Institution Economics, practice approach benefit by the contribution of main Finnish extension services "Pro Agria".

The study overviews food security and wood fuel use as linkages to bio energy sector.

Cooperation for governance of resources and environment is discussed, considering transaction costs and property rights. Under this point of view the Clean Development Mechanism is introduced, as a tool combining bio energy production and environmental purposes; legal aspects and participation planning by community are described.

Planning, information and improving self-organisation of governance for management of biomass and natural resources are functions analysed through the Finnish extension services and experiences made on field in Finnish countryside. Co-operatives and networking of producers of biomass for heating and/or electrification are structure of governance discussed from data gathered on field; and hypothesis under broad thresholds is done.

Considerations derived from theory and Finnish experience are finally applied to a pattern of economy in transition, specifically to Republic of Moldova; impact that Extension Services can have for sustainability of bio energy production for energy and/or heating purposes in rural areas are reported as conclusions, considering small network of producers.

Dedication

This work has been developed under a peculiar period of change in my life.

I want to thank, really with gratitude, Fredrik Ek (Pro Agria, Finnish Extension Services). Without him would not have been possible to have done such an experience in Finland, driving the first wood-fuel car in my life. I will remember him for his patience, disposition and kindness, for his deep interest and passions, for his capability of inventions. And, clearly, for the tar… ☺ and special thanks to his future wife, for the patience for having a future husband kidnapped by his work and the thesis of an Italian…

I want to thank my professor John Sumelius, for having assisted me in Finland and helped me to do this experience; and professor Raffaele Cavalli, for entrusting my willingness to do this work.

I am even grateful to Dr. Vitalie Gulca (State Agricultural University, Moldova) and Dr. Said Abdallah (Aalborg Universitet, Denmark) for their interesting personal communications on their field of research.

Thanks to the Finnish farmers, those language made me feel really at home with ease. I am grateful again to Mr. Ek, for interpreting.

Thanks to wordreference.com: with an English paper dictionary, probably when one currently was reading this dedication, likely I'd have been still looking up.

A special smile to all those Finnish who believed I was a Finnish kidding them despite speaking not at all Finnish and talking in Italian to make evidence, just because I clearly look like Finnish.

A special thought to the seagulls of Helsinki, for dressing with magic the morning in the city.

Special thanks to my Family, for the patience had for an idealist son, in love and in critic at same time with the world and his own life. All my love to my young brother Flavio: I have been travelling so long, and have had so few time dedicated to him: I hope he will understand one day, and I hope we will be closer.

Finally, special thanks to Who I loved and lost, and taught me to believe as well.

And to my heart and brain, to have made it, keeping love and faith through the everlasting change in the meaning of the Life.

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Summary

This study concerns the role of Extension Services as institutional structure of governance in biomass production for energy purpose, and benefits of experiences on field in Finland made with extension services Pro Agria, through surveys administrated in bio energy meetings of farmers and extensionist as well. Hypothesis for sustainable rural development is made in conclusion, regard to the small networks of producers, considering dimension of farms and consumes for heating and power.

First chapter introduces the bio energy sector, through the FAO definitions; linkages with food security and wood fuel consumption are taken into account.

Second chapter introduces guidelines in cooperation through the New Institutional Economies approach.

Third chapter analyse some aspect of theoretical approach into the Clean Development System.

Fourth chapter reports methodology and results obtained through research on field in some Finnish rural areas with Extension Services Pro Agria.

Fifth chapter applied some considerations gathered from data and theory to a process of change in transition economy, therefore the role of extension services in sustainable development of bio energy sector.

Sixth chapter concluded with some recommendations for development of self-organised institutional structures of governance for bio energy resources, an hypothesis about small networks of producers as model of sustainable governance, thus the role extension services can have in the process of change toward more environmental friendly practices in bio energy.

Appendix A is about consideration of a case of private entrepreneurship about self-production and consumption of bio energy in a farm of Finland.

Appendix B shows social criteria derived from leading standard setting organisations, for CDM.

Appendix C reports the questionnaire administrated to the Extension Service itself.

Introduction

Bio energy[1] is taking a very important role in world energy supply.
Increasing energetic demand that development leads to, economic assets such as the price of fossil fuels and availability of resources, environmental agreements and protocols are characterizing the scenario of employing biomasses as alternative and even strategic resource in national economies.
On the other end, there is quite a critic about the sustainability of processing energy from biomasses, concerning the total energetic balance and efficiency, as well the environmental impact into water and land use.
Furthermore, bio energy crops as such, compete with food production; it will be discussed further in chapter 1, as well wood use trends.

Regarding the demand of energy for a country, bio energy covers a key role at three decision-making spheres for securing energetic demand: at inner policy level (concerning the role of the state and private sector); at inner local situations concerning informal or in transition economies; at foreign policy (energetic dependency can affect sovereign and political choices in transition economy and developing countries).
Environmental impact of each decision-making process is linked with property rights (re)distribution, defining a change in institutional governance; it will be discussed in chapter 2, through the New Institutional Economies (NIE) approach.

Legislation can in a way contribute in setting the path towards a "clean" use of energy pointing at sustainable criteria, but the lack of standard certifications for sustainability in bio energy project is an up-front obstacle.
The faded concept of sustainability tends thus to be subjected to the interpretation of the stakeholders designing projects. A significant contribution to gather information at local level, and to endorse capacity building among the communities, is provided by extension services: their role in institutional governance change will be discussed under the NIE approach as well, under chapter 2. The linkage of the possibility of designing combined project for bio energy production and reduction of greenhouses gas emissions, under the Clean Development Mechanism (CDM) defined by Kyoto protocol, is discussed as well in chapter 3.

[1] **Bio energy:** energy from bio fuels. **Bio fuel:** fuel produced directly or indirectly from biomass such as fuel wood, charcoal, bio ethanol, bio diesel, **biogas** (methane) or bio hydrogen. **Biomass:** material of biological origin excluding material embedded in geological formations and transformed to fossil, such as energy crops, agricultural and forestry wastes and by-products, manure or microbial biomass. Bio energy includes all wood energy and all agro energy resources. *Source:* FAO, 2006. Introducing International bio energy platform (IBEP)

This study wants to be a contribution to give more concreteness to the concept of sustainability related to bio energy projects. Sustainability in a developmental process has been told as "[meeting] the needs of the present without compromising the ability of future generations to meet their own needs"[2].

This study assumes as easier sustainable a *local* system, able to maintain the availability of resources in long term period.

The more a *local system*, with its pattern of values regulating choices of stakeholders, is linked to other *local systems,* or to *upper scale* systems, the harder is to define the sustainability related to local system itself.

For instance, in developed countries, it is harder to define a *local system* as such, since it is usually well regulated by legislation and well connected to surrounding economic environments; in developing countries, a lack of information on how informal or not marketed economies work can lead to the same problem.

The net of the linkages, among many systems interacting each other, results in a quite complex and of big dimension "open system"; unless defining specific boundaries in which analyse the sustainability inside a smaller system, the concept of sustainability defined above may be blur, and end up to turn unsustainable at upper scale systems[3].

Well established market of energy may not represent well established practices of sustainability in resources: local sustainability could be paying for a wider unsustainable process at macro scale.

Thermodynamically being not possible a process with output efficiency of 100%, best solution turns in considering which assets should be taken into account locally, and possibly considering bottom-up connection between local institutional structure of governance coordinated in a bigger network. While Chapter 2 traces a theoretical approach, the option of CDM-bio energy combined projects is discussed in Chapter 3, as a wider thresholds structure of governance designed to take into account environmental and economic transaction costs at the same time.

Finally, in chapter 4, this study will discuss about the linkage between macro scale goals, for investing in bio energy as renewable resource, and the micro scale needs of farmers, involving expectation of incomes and economic feasibility. On purpose, Finnish extension services start up a new branch in the bio energy sector in 2007. This study benefit of a three-month period (March, April, May) in which has been possible to follow up extension activities on field; administration questionnaire to farmers, land users and extensionists themselves; gathered data on the field; visit

[2] UN, General Assembly document A/42/427. *Quoting from* Gro Harlem Brundtland, Report of the Brundtland Commission.

[3] For instance, by side of developed countries, national subsidies for bio energy plants could give the idea of an environmental friendly practice among stakeholder at local scale, but likely it will turn unsustainable if the bio fuel is imported from somewhere else. By side of developing countries, intervention made for improving the bio mass production to supply the energy demand can turn unsustainable for the surrounding environment, if practices and attitudes of local stakeholders are neglected at decision making process.

remote rural areas in the countryside of Finland; assist to the proposal of ideas or projects brought by farmers themselves.

Lastly, resulting consideration from this experience and sketches for an interest deepening are applied to the Republic of Moldova, chosen as representative of a developing country with economy in transition.

1. Developing bio energy sector: an overall and social environmental linkages[4]

1.1 Introducing the FAO's International Bio energy Platform (IBEP) - 2006

The overall objective of the International Bio energy Platform (further, IBEP) is: "Ensure the delivery of sustainable, equitable and accessible bio energy sources and services, irrespective of gender, wealth, location or culture, in support of sustainable development, energy security, poverty reduction and climate change mitigation."

FAO Capabilities has been consolidating in the field of bio energy; the aim of the IBEP is progressively assisting its member countries in their decision-making processes in this field.

The IBEP constitutes of two pillars, one for bio energy knowledge management, and one for mobilizing bio energy.

The tasks proposed for the first biennium of activities are: analysing and establishing a knowledge network, potentials, sustainability, implement the I-BIS Portal; foster capacity building and stakeholder participation, partnership and cooperation, and develop an assistance programme framework in collaboration with UN-Energy (FAO bio energy).

IBEP is indented to be a future reference in projects in Developing Countries oriented in Bio energy Solutions: the platform "aims to provide the critical links to facilitate transition to a sustainable energy future, matching local and global benefits and taking into account the well-being of future generations", and is presented as a mechanism to a multidisciplinary and global approach to the role of bio energy in agricultural and environment sectors.

Role of bio energy is going to be a key in global development, cause its production and management is highly connected, at macro scale, with current environmental issues of global warming, carbon sequestration, environment prevention, alternative and renewable sources of energy and higher independency in energy supply from fossil sources (hence a more stable economy).

[4] FAO, 2006. Introducing International bio energy platform IBEP

At regional or local scale, bio energy role takes into account issues of deforestation and sustainable management, a more efficient use of natural resources (in particular wooden one), multifunctional agriculture and an opportunity of development of services such as heating and electrification in remote areas.

Bio energy has a very wide footprint across all the stocks of natural and human capital, due to the requirements for land, water and labour, and the interrelationship with traditional forms of energy and food provision. "Understanding the diverse range of system components, system behaviour and system inputs, outputs and impacts, and exploiting them to ensure sustainability, requires a flexible framework for implementation that is not restricted by national boundaries or narrow interests5".

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[5] *Ibid.*

1.2 Linkages between Bio energy and food security

FAO's interest in bio energy stems from the positive impact that energy crops are expected to have on rural economies and from the opportunity offered countries to diversify their energy sources. On the other hand, the global switch to bio energy can have heavy impacts on international commodities prices, when bio energy promotion drives to large-scale biomass production based on intensive cash-crop monocultures.
Some considerations will be taken to define which kind of biomass and contest this study is taking into account and focus on.

Among bio fuels, ethanol is taking a more and more interesting role in global economies and fuel supply; this is leading to strong linkages between crop cultures and oil prices, as the graphic below shows.

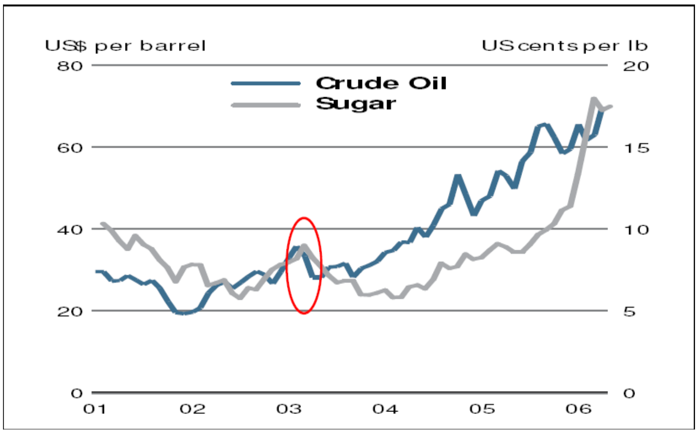

Figure 1 - Trend Prices of crude oil and sugar (2001-2006)

Source: NYMEX, IEA, FAO[6]

Estimated *parity* prices between crude oil and sugar[7] see an increase to almost 14 US cents per pound or raw sugar, per 70 US dollars per barrel of crude oil.
Different incentives are undertaken in the production of ethanol, as the international comparison below shows.

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[6] *in* Nyberg, J. 2006. Global Bio energy Partnership. Bio fuel in Africa -Risk and Opportunities: Food, Feed or Fuel? FAO, Commodities and Trade Divisions. Sixth Meeting of Global Forum on Sustainable Energy (GFSE), Vienna, 2006.
[7] *Ibid.*

Table 1 - Incentive in the production of ethanol - international comparison

Country	Production incentive	Reduced excise tax	Import tariff (MFN)	Exceptions from tariff
Australia	–	28.9¢ Value of rebate on excise tax	28.9¢ Effective rate because excise tax not rebated	None
Brazil	–	30¢ (Sao Paulo)	–	MERCOSUR
Canada	up to 16.4¢ (variable rate)	up to 15.1¢ (BC)	4.3¢	NAFTA, DR-CAFTA, Chile
EU	–	up to 70.9¢ (Ger)	24.1¢	EFTA, GSP (excludes Brazil)
Switzerland	–	57.8¢	27.7¢	EU, GSP (includes Brazil)
USA	13.5¢ + state	up to 8.4¢ (MO)	2.2% + 14.3¢	NAFTA, CBI, DR-CAFTA

Source: Drexhage and Steenblik, IISD-GSI, Subsidies and Bio fuels in the United States (2006)[8]

Economic pushing feeds back political choices, and in Africa different bio fuel initiatives are taken to get into the business[9].

Table 2 - Strategies among African Countries for ethanol production

Countries	Initiatives
Tanzania, Zambia, Mozambique, Zimbabwe and South Africa	new National Strategy, two new mills + ethanol + sugar beet
Angola, Democratic Republic of Congo and Madagascar	to revitalize small sugar industries
Sudan, Ethiopia, Malawi, Zambia	to expand production and lower costs
Burkina Faso, Cote d'Ivoire, Mali, Senegal	all have proposals for ethanol production
Benin/Guinea-Bissau	cassava/cashew
Niger/Togo	Jatropha Policy environment: create markets

Source: extracted from, ibid.[10]

Previsions to 2010/2011 forecast an exponential increase in sugar production, in northern and southern west of Africa, headed by Ethiopia and Sudan (production boosted more than two-fold). Table below show the data.

[8] *Ibid.*
[9] Data extracted from: *Ibid.*
[10] *Ibid.*

Table 3 - Increase of Sugar production among Western Africa

Country	------Sugar	Production--	Increase
	2005/2006	2010/2011	
Ethiopia	300 000	450 000	150%
Malawi	263 536	350 000	33%
Mozambique	260 093	480 000	85%
Sudan	750 000	1 000 000	250%
Swaziland	643 688	740 000	25%
Tanzania	302 000	570 000	89%
Zambia	242 195	430 000	78%
Total	1 711 512	2 570 000	50%

Source: Canegrowers South Africa 2006

How does the economic push, towards bio fuel extensive production, effect international commodity prices? Simulation by FAO Agriculture at 2030 analyse the impact of an additional 10 million tons to some relevant bio energy crop productions, looking on how they would affect the price of relevant food commodities (including bio energy crops as such).

The table 4 shows that the effect of the rising price of crops could be a dietary convergence or increased demand for livestock feed, and a consequent pressure on land (due both to pastures and cultivations).

Therefore, despite opportunities of dedicated market outlet for farmers and rural employment/increased incomes, there could be serious risks due to poor land use and crop choice, price pressures in near to medium term, particularly net food importers.

At macro scale, opportunities could be given by new business models or cooperative approaches, but pressure on less competitive sugar industries, following investment patterns due to globalization, trade uncertainties in WTO or regional markets could likely lead to uneven distribution of benefits, as a factor of exclusion for small cluster of farmers.

Likely, in developing bio energy potentials and strategies, hazards could be that large-scale promotion of bio energy relying on intensive cash-crop monocultures could see the sector dominated by a few agric-energy giants – without any significant gains for small farmers; in high social disparity contests competition for land use in terms of food production might be overstated in favour to a higher incomes; the large climate change mitigation potential could be diminished, due to pushing weaker part of population to unsustainable practices for subsistence with pressures to the resilience of ecosystem.

Table 4 - Simulation of impact on food commodities for additional tons in energy crop

Feedstock	Sugar	Maize	Sugar and Maize	Soybeans and Maize	Sugar, Maize Soybeans
Corresponding energy [biofuels]	0.195 EJ	0.087 EJ	0.282 EJ	0.167 EJ	0.349 EJ
Sugar	+9.8	+1.1	+11.3	+2.3	+13.8
Maize	+0.4	+2.8	+3.4	+4.0	+4.2
Vegetable oils	+0.3	+0.2	+0.2	+7.6	+7.8
Protein	+0.4	−1.2	−1.2	−8.1	−7.6
Wheat	+0.4	+0.6	+0.9	+1.8	+2.0
Rice	+0.5	+1.0	+1.2	+1.1	+1.4
Beef	+0.0	+0.2	+0.2	+0.4	+0.4
Poultry	+0.0	−0.4	−0.4	−2.1	−2.0

Source: FAO Agriculture 2003

Therefore, specific analysis are required at national, and regional level; particular attention to a complex macro, meso, micro level interaction should be given; the FAO's IBEP is a tool intend to provide expertise and advice for governments and private operators to formulate bio energy policies and strategies.

Anyway, concerning remote rural areas in developing countries, without a proper institution acting between them, difficultly these practices could percolate down to local community, facing problems as the lack of private operators in uncertain markets (informal economies), and uncertainty for the ongoing redefinition of property rights (transition economy).

1.3 Current roles and perceptiveness of Wood fuel

In 2002, about 2 450 million m^3 (equivalent to 23 600 PJ) of wood fuels (fuel wood, charcoal and black liquor) were consumed worldwide for energy - about 560 million tonnes of oil equivalent (Mtoe). They supply about 5% of the world's total energy requirement, and represent 44.8% of world total renewable supply[11].

The amount and types of wood fuel used vary considerably between regions, mainly due to different local situations and conditions.

Considering macro-areas where are settled the least developed Countries, Africa has the next highest share at 31% (African wood fuel consumption reached 623 million m^3 in 1994)[12]; Asia is by far the largest consumer of fuel wood, with 48% of the world production; South America, at around 8.6 and 8%, respectively[13]. Europe consumes around 4%, most of which is derived from the use of black liquor from the pulp and paper industries.

Africa is the most intensive user of charcoal, with around 50% of the total world charcoal production. Most of the charcoal is used by urban dwellers, although some quantities are used by commercial (restaurants) and industrial users (metallurgical applications).

In Africa, almost all countries rely on wood to meet their basic energy needs. The share of wood fuels in African primary energy consumption is estimated at 60–86%. On average, about 40% of the total energy requirement is met by fuel wood in Africa.

In Asia, about 7% of the total energy consumption is met by wood fuels; wood energy situation varies deeply from country to country. In Europe, the share of fuel wood in total energy requirement is low, at 1.2%; in Austria, Finland and Sweden wood energy provides around 12–18% of their total primary energy supply[14].

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[11] WEC - World Energy Council.
[12] FAO, 1993.
[13] FAO, 2001.
[14] WEC - World Energy Council.

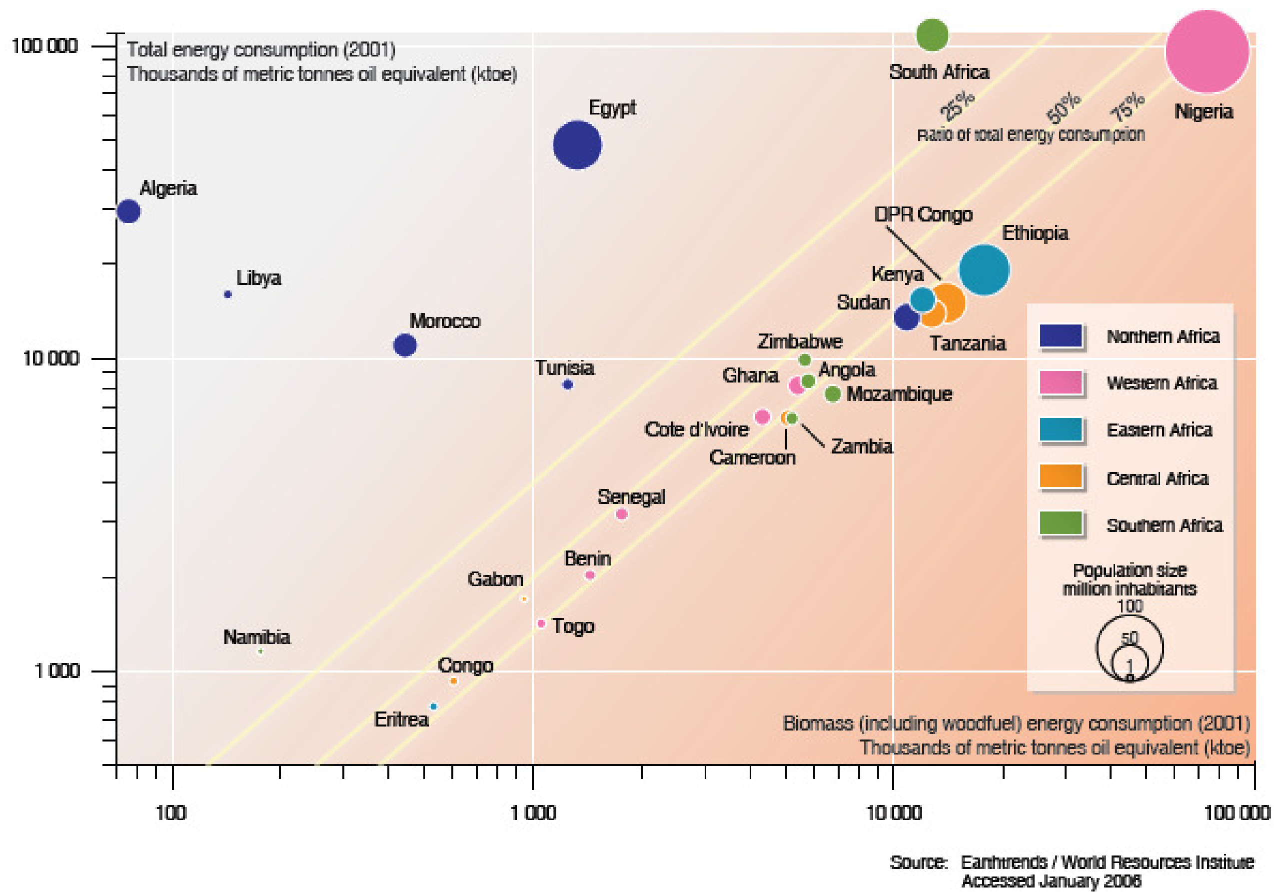

Figure 2- Total energy and biomass consumption, Africa.

Biomass, primarily wood fuel, is the major source of energy in Sub-Saharan Africa, with the exception of South Africa. Over 90% of the total energy consumption is biomass in Ethiopia, DPR Congo and Tanzania. Projections estimate that this will further increase, together with population increase and higher energy needs. In total energy consumption, populous countries, such as Nigeria, South Africa and Egypt have the highest totals.

African *per capita* wood fuel consumption[15] (0.889 m^{3}/year), the management and demand of wood fuel resources are among major issues in energy planning processes.

Wood fuel consumption is a major contributor to total wood *removal*, accounting for around 92% of total African wood consumption.

Forestry planning and environmental protection processes hardly effectively meet energy demand. Among the causes stressed by FAO and WEC, and in general by international agencies focusing on social-economic research of this sector, there is common agreement that wood fuels play roles within gender[16], urban migration[17], family incomes[18]; the economic value of wood fuel was around US$ 6 billion for the whole of Africa, and 1/6 of this amount was made up by charcoal (1993).

[15] based on data provided by FAO 1994.

[16] Women are generally the most concerned by fuel wood issues since they devote a lot of their time to fuel wood gathering and cooking tasks; charcoal production and marketing on the other hand tend to be more formalized and male-specific, helping to provide jobs and substantial revenue for rural and urban people.

1.3.1 Wood fuel use in Africa

Sector analysis[19] reveals the importance of household consumption, estimated between 86% and 95%of total African consumption in 1994, despite a slight drop in the household share trend of total wood fuel consumption (from 90% in 1980 to 86% in 1994). Anyway, total consumption increased due to demographic expansion; more dense centres could explain trend change as shifting from residential energy uses (particularly for cooking) to informal tertiary catering.
Hence, user location (rural or urban) is a determining factor in utilization patterns.
Unfortunately, in analysing data provided by different sources (international and national) aggregated data, FAO is reporting that "the existing information could not be interpreted given: uncertain quality data sources; gaps for estimating missing values in each country; no detailed rural and urban consumption figures in different countries.
Anyway, analysing the type of wood fuel, there is an indication of the ongoing substitution process from fuel wood to charcoal even in rural areas.

Table 5 - Contribution of Various Types of Wood fuels to African Wood fuel Consumption (million m^3)

Year	1980	1985	1990	1994
Fuel wood	435.5	458.1	480.4	507.0
Charcoal	76.5	89.0	108.5	113.0
Black Liquor	1.6	1.5	3.0	2.5
Total	513.6	548.6	591.9	622.5

Source: FAO 1994

Table 6 - Contribution of Various Types of Wood fuels to African Wood fuel Consumption (%)

Year	1980	1985	1990	1994
Fuel wood	84.8%	83.5%	81.2%	81.5%
Charcoal	14.9%	16.2%	18.3%	18.1%
Black Liquor	0.3%	0.3%	0.5%	0.4%
Total	100.0%	100.0%	100.0%	100.0%

Source: FAO 1994

As the table 6 show, the charcoal share grew from 15% in 1980 to 18% in 1994 at the expense of fuel wood. Growth rate of fuel wood consumption was 1% per annum during the period 1980-1994, thus lower than total population growth (2.8%, same period) and lower than rural population

[17] Increasing demand of charcoal towards high dense urban cities.
[18] difficulties in marketing fuel wood due to low price respect to different uses (e.g. construction); fuel wood traditionally accounted for a major part of total wood fuel consumption, but the social and economic changes associated with urbanization is leading to a significant shift from fuel wood to charcoal, more worthy. There are signs of developing international trade of wood fuel between European and North American countries [FAO, 2003], due mainly to oil price raise.
[19] FAO and IEA data.

growth (2.1%/yr). Charcoal consumption instead grew by 2.8% during the period 1980-1994, matching population growth.

"In the production of charcoal, [typically around two-third of the energy is lost in the process] (60-80%), even if [charcoal has advantages over fuel wood like stoves with higher efficiency, higher convenience and easier distribution]"[20].
Higher efficiency rates means higher investment cost in the construction of the kiln, and earth kilns are still the cheapest solution: can be made at minimal cost, are often used near wood resources, since they can be made entirely from local materials; their duration of the process range from three days to two months.

Energetic efficiency and price of fuel wood or fuel wood based products are two main indicators used for valuation of a sustainable use of NTFPs[21], but there are complex factors that make the value change, such as the desire and escape from rural areas, the desire of a better income, political changes, amount of accessible trees and, among all, population growth. There can be distortions making market price not an accurate representation of the real value; undervaluation of fuel wood sources might lead to their unsustainable management.

Generally, few data are available for Developing Countries on purpose of an accurate estimation of fuel wood's value; moreover the availability is for macro areas and different data are subjected to different interpretation and results depending on the way they are collected. Monetary estimations can only indicate the order of magnitude of the value, but in order to serve as a tool in making right decisions in management of fuel wood and benefit of the population, they should be completed with local data and information mainly concerning accessibility of resources in the territory[22].

Improving knowledge on wood fuel demand and supply on economic and social role should be undertaken to make proper intervention in supply chains of fuel wood and charcoal and affecting use trends[23].
Extension services should take into account these matters, to drive towards feasible solutions and accepted choices; sustainability should be an aim to be reached in medium or long term[24], to be "felt", not simply chosen, as the better option.

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20 "Wood Energy Conversion" in FAO-RWEDP. Regional Wood Energy Development Programme in Asia. www.rwedp.org/ See also: http://www.ces.iisc.ernet.in/energy/HC270799/RWEDP/i_conversion.html
21 Not Timber Forest Products
22 Methods like PGIS, PPGIS and 3DGIS could carry out functions as mapping resources or social mapping for territorialisation, even if currently there is a lack of analysis on cost efficiency of such practices.
23 *For instance:* fuel wood is frequently collected by women for self-support or poor people; thus gender issue can effectively help understanding who depends on fuel wood/charcoal, who are collectors, sellers, users, and be a useful tool to be used with monetary analysis.

Extension activities depend on time terms and "working scale"; purpose is depending on needs of people requiring for extension.

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[24] Unlikely in short and medium term institutional choices recommended by FAO will be effective in sustainable perceptions and needs for bio energy issues related to gender, deforestation, health.
Below an abstract of FAO´s recommendations, *stressed* on purpose.
"In the short term, it is recommended that a more efficient data collection process be created. This might be achieved through :

- identifying the relevant institutions and experts in each African country, and formulating a new collaboration process;
- modifying the data query procedure;
- defining a new *questionnaire* to address the issues relevant to wood fuel use.

2. In a medium-term, the quality of wood fuel data in Africa should be improved considerably by launching a pilot program targeting the major consuming countries or the countries where data quality was particularly poor. The programme should be centred on field *surveys using an adequate methodology and surveying approach*.
3. In the longer term, it will be necessary to develop and establish a data collection and updating framework in each African country and a systematic transmission process to FAO, which would act in an observatory role, compiling, aggregating and storing the data. It is worth noting that this new process would need to be accurately defined in order to facilitate the aggregation process. Suggested programme components could include:

- launching an ongoing observation process for wood fuel data;
- defining a collaboration framework between African countries and FAO on wood fuel in order to monitor the process appropriately;
- defining regional collaboration and *exchange of experience frameworks* among African countries.

4. While the current study did not address *socio-economic issues related to wood fuels*, they definitely *constitute a turn-key subject* for which information needs to be collected and improved internationally or even produced at national level. As a first step, it may be possible to adopt a simplified approach aimed at improving knowledge, and subsequently use the results to launch *localized pilot studies that could be extrapolated* to the whole of Africa."
Source: Amous, S. 1999. The role of wood energy in Africa. Series: Wood Energy Today for Tomorrow. FAO

1.3.2 Wood fuel use in Europe

During 1990s, wood energy consumption constitutes about 3% of the total primary energy consumption in the Europe; in volume terms, as over 45%[25] of the removals annually are used for energy.

Forms of use of the wood vary from fuel wood, residues of processing industries, used wood. Statistical information on wood energy is not of high quality, because of the decentralized, scattered nature of wood energy use and the fact that wood energy is often auto consumed by forest owners or forest industries, which do not pay for their wood energy and therefore are not obliged to keep records.

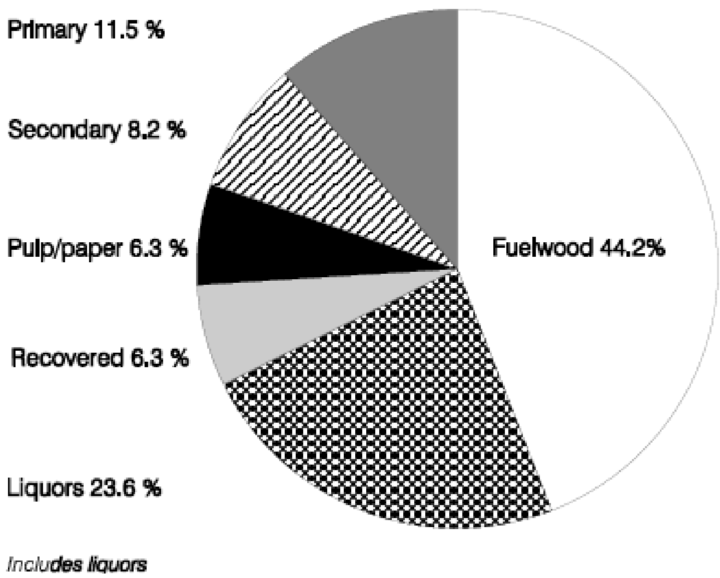

Figure 3 - Europe**: wood for energy by type of wood energy, 1990**

Source: European Timber Trends Study V

Generally, FAO studies identify two extremes observed in Europe. On the one hand there are the countries where wood energy is mainly consumed in the form of direct forest residues. Often this is traditional use in households[26]. On the other hand there are the countries that have a well developed

[25] UN, ECE/TIM/SP/11. European Timber Trends and Prospects: into the 21st Century.

[26] Households' consumption of wood energy by user in 1990 was 63 m3 and 65%, considering only some of west Europe countries (Austria, Denmark, Finland, France, Germany, Norway, Poland, Sweden, and Switzerland) and former Yugoslavia. *Source:* ECE/FAO, 1996. European Timber Trends and Prospects: Into the 21st Century. Series title: Forestry Sector Outlook Studies - ECE/TIM/SP/11

forest industry including a large pulp and paper sector, such as in Finland and Sweden, where the share from indirect wood fuels and black liquor dominate[27].

The industrial and transformation sector consumes most wood energy; extension's programmes in agriculture advisory services (such as Pro Agria and Biovakka) include consulting on solutions suitable for farms on self-use aim, heating and/or electricity. Wood energy consumed in households is still the largest share of wood energy in Europe, with implications for environmental impact. The CO_2 neutral character of wood energy is the main advantage, being at present the rate of harvest of wood lower than the rate of regrowth[28].

Concern about possible climate change, due to a build up of greenhouse gases in the atmosphere is one of reason of the strong interest in renewable energy sources at the policy level is at the policy level.

Other assumptions are the changes in agricultural policy, which have created an opportunity to increase significantly domestic supplies of biomass energy by the establishment of intensive, fast-growing energy plantations[29] and the dependency of transition economies on subsidised imports of energy, (mostly oil and gas) from the former Soviet Union. The economic problems of these countries, severely reducing disposable income and foreign currency reserves, have caused severe energy shortages in many of them: one of the solutions found has been wood energy use, especially in the poorer rural areas.

Factors affecting economical attraction of wood energy are price; availability of others type of energy will; given place to large scale production of energy wood in policies; regulations concerning emissions[30]. McCormick (2005) further distinguishes that "the impacts of bio energy systems are shaped by the location and management. Establishing sustainable bio energy systems requires attention on several issues; [but results are striking into] multiple benefits across environmental, social, and economic spheres [as] observed in regional development"[31]. Particularly,

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27 In Finland household consumption account for 39%, forest industries for 60%, in the wood energy consumption. *Source: ibid.*

28 FAO, COMMITTEE ON AGRICULTURE, 2005. Bio energy. COAG/2005/7. Article 13 (*stressed on purpose*):
"As a carbon-neutral source of energy, bio fuels can also contribute to climate change mitigation *through substituting fossil fuels,* when sustainably produced, and through carbon sequestration in forest and soils through *afforestation and reforestation activities* and improved land and forest management practices. Nevertheless, the ability of bio energy to reduce green house gas emissions varies depending on the forms of biomass utilization. In some instances, bio energy generation may even prove negative in net energy value."

29 About this, "Considerable research has been carried out on the modalities of this, but so far, the extra contribution to national energy supplies has been marginal" - *source:* ECE/FAO, 1996. European Timber Trends and Prospects: Into the 21st Century. Series title: Forestry Sector Outlook Studies - ECE/TIM/SP/11.

30 such as volatile hydrocarbons in wood burning.

31 Such as: design of carbon neutral system; sustainable practices when utilising agriculture and forest residues; control of emissions.

attention should be given onto direct employment effect from bio energy solution. The table below shows that in Sweden, the number of *direct* jobs created per unit of primary energy supply from woody residues is a factor 1 to 10 higher than is the case with coal as a primary fuel. For willow as an energy crop this is even a factor 3 to 14 higher than with coal.

Table 7 - Direct employment of various bio energy options in Sweden[32]

	Harvesting	Chipping	Terrain transport	Road transport	At energy plant	Admini-strative	Total
Sawmills				5	1	2	8
Recycled use			5	3	1	4	13
Logging residues		13	8	5	1	4	32
Direct harvesting of fuel wood; manual	38	20	5	5	1	4	73
Direct harvesting of fuel wood; mechanical	5	15	5	5	1	4	35
Wood fuel for small scale household use	**38**	**20**	**5**				**63**
Willow short rotation coppice, manual harvesting	**15**	**8**	**23**	**25**	**37**	**4**	**113**
Willow short rotation coppice, mechanical harvesting	9	2	2	6	1	4	25
Canary Reed	**10**	**8**		**6**	**1**	**1**	**26**
Straw	**4**	**8**		**8**	**1**	**2**	**23**
Coal							8

Source: *extracted from, Footnote*

McCormick designs a scheme that can be useful to evaluate impacts of bio energy systems at different scales, adapted in the table below.

For European Bordered Countries, such as Republic of Moldova, with high importation of energy; Albania, with traditional use of wood in households[33]; or "countries in the Caucasus, Central Asia,

[32] Data show number of man-years per PJ. *Based on survey of:* Hektor, B., 1992, 1996 revised in Van den Broek, R. 1997 The role of wood energy in Europe and OECD. FAO.
1 PJ = 277MW/h, considering conversion rate: 1J = 2.7778 x 10E-7 KW/h.

[33] Van den Broek, R. 1997. The role of wood energy in Europe and OECD countries. FAO

on the Balkan and also Turkey for where wood fuel remains of great importance for the rural population [...]"[34] this scheme could be an interesting reference especially considering the issues of employment, stimulating partnerships, and improving energy security. These goals are in line with the EU policy target of increasing the share of renewable energy in energy production, hence point of interest for Candidate Countries or Countries with high energetic dependency and/or in hot-spot political position[35].

Table 8 - Perspectives on Sustainable Bio energy Systems[36]

Level	Impact	Bio energy systems can
Global	Combating Climate Change	Decrease carbon dioxide emissions if replacing fossil fuels, establishing energy crops, or integrating with carbon capture and storage.
National	*Improving Energy Security*	Increase the resilience of energy systems (*factors*: range of viable biomass inputs; different conversion technologies; options for energy outputs).
Local	Promoting Regional Development Distribution and Diversification Partnerships and Synergies Business and *Employment* Environment and Landscape	Contribute to regional development in several ways. Promote distributed and diversified energy systems. Stimulate partnerships to exploit synergies *(such as network of small farmers?)* Generate (direct and indirect) employment and business. Support environment and landscape goals.

Source: *extracted from, Footnote*

[34] Belgrade report: "Achieving sustainable use - forestry and agriculture" http://belgrade-consultation.ewindows.eu.org/reports/rep285401/chp248445/sec978610

[35] Such as Republic of Moldova; the European orientation which enjoys the recognition of notable European political analysts is supported at national level by a series of actions such as the National Commission for European Integration (established in 2000); anyway, "before talking of EU support, it is important to recall the impact of relations with Russia: during recent months we have seen gas price increases for Moldova, import bans on Moldovan and Georgian wines and water; the *de facto* support given to Transnistria on the referendum, and the strong reaction to the Georgian expulsion of Russian military officers aimed at institutionalizing this process"
Source: Ferrero-Waldner, B. Strasbourg, 25 October 2006. 'Frozen Conflicts': Transnistria, South-Ossetia, and the Russian-Georgian dispute. In Proceedings European Parliament Plenary, Strasbourg. SPEECH/06/629

[36] *Adapted from*: McCormick, K. 2005. Sustainable Bio energy Systems: Experiences from Sweden. Brennan. *Stressed* on purpose.

1.3.3 Scenarios in Transition Economies

Common feature of transition economies is that were all under a centrally planned system and are now moving towards a more marketed-oriented system. For the forest sector, the centrally planned system usually involved public ownership and management of forest land; centralized decision taking on forest policy; under-capitalized forest industries; low levels of consumption (even in a forest-rich countries, due to the system rigidities and shortages); "managed trade" through COMECON[37] system. The level of forest management in the former centrally planned economies was generally good from a technical point of view, using practices which were modern in the biological and environmental fields, but otherwise conservative, economically inefficient and inflexible. Most of the countries had an explicit policy of high quality wood production, even though the costs incurred by the silvicoltural practices chosen were sometimes excessive.

Effects explain high levels of growing stock per hectare, but with discrepancy in industrialized consumption and standard living generally shaped by small disposable incomes. Severe unemployment has led to very weak domestic markets for all forest products, as well as to reduced import demand from other transition economies.

In particular, effective demand for housing has been weak, despite the strong latent demand due to the generally poor state of the housing stock. Increased competition of local firms, facing western firms, and low demand have forced many forest industries and enterprises to close, as generally obsolete or rose onto an inefficient industrial base.

How these features could link with a changing scenario in Energy prices and policy?

Starting point of consideration is a significant rise in the price of conventional forms of energy, as shown in trend of crude oil prices below[38], and the series of policy measures to develop and encourage other renewable sources[39].

[37] Council for Mutual Economic Assistance

[38] For an oil Price History and Analysis: http://www.wtrg.com/prices.htm

[39] For an historical about some tax measure and discussion about policy related to environment and energy: *Global Policy Forum*, http://www.globalpolicy.org/socecon/glotax/carbon/index.htm

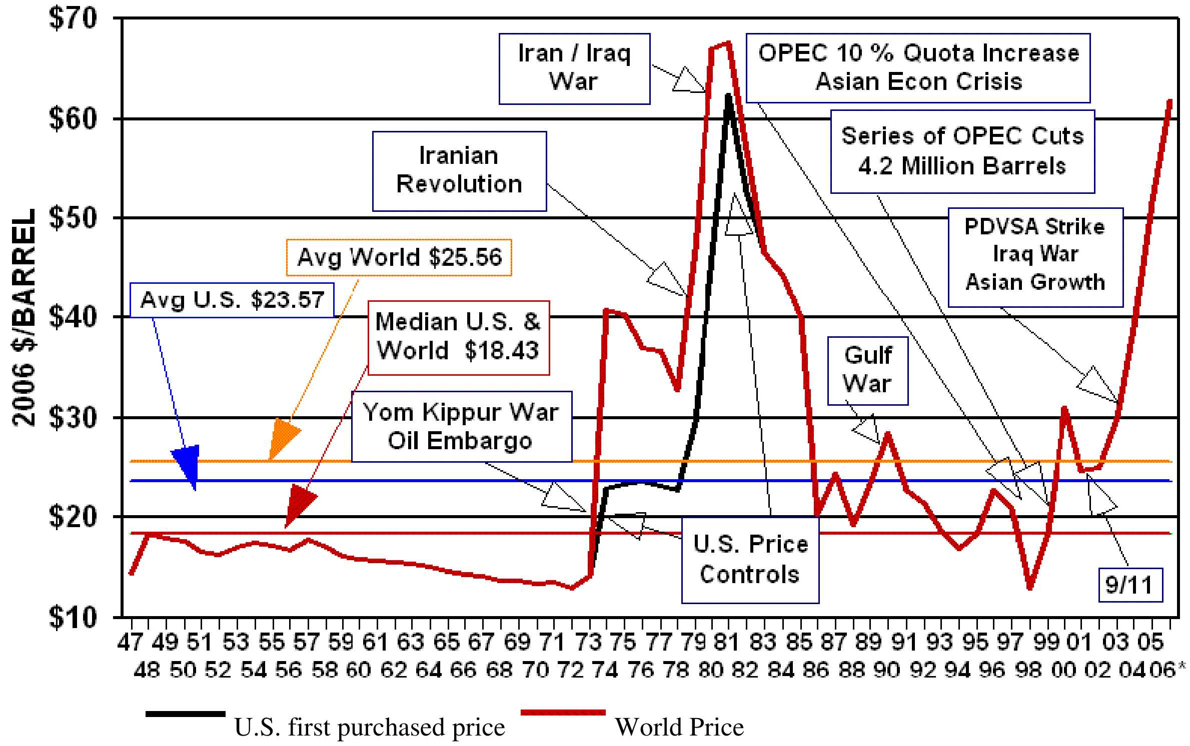

Figure 4 - **Crude Oil Prices 1947 -September 2006**

Source: WTRG Economics

Assuming that wood is not subjected to a carbon tax, the first consequence of a rise in the price of energy[40] and is likely a sharp improvement in the competitive position of wood as a energy source; policy measures to stimulate its use would lead to increased fuel wood harvests and even greater use of wood residues (from primary and secondary processing) as energy source.

Since there is a diverse market with fuels of different qualities and of different origin, and that some actors demand one quality of timber and produces by-products which are very essential for others, this could creates competition between traditional users[41] and the energy industry, mainly regarding small-diameter wood and by-products.

The figure below shows the regular use and utilisation of raw materials and the links between different actors.

[40] Due to policy decisions (like Kyoto Protocol for reduction of green house gas emissions, or programs stimulating wood for energy like the trade of emissions planned for the EU and some other linked countries such as the Russian Federation) or unexpected supply breakdown in fossil oil supply (Iraq war, see graph above).

[41] such as domestic use of heating.

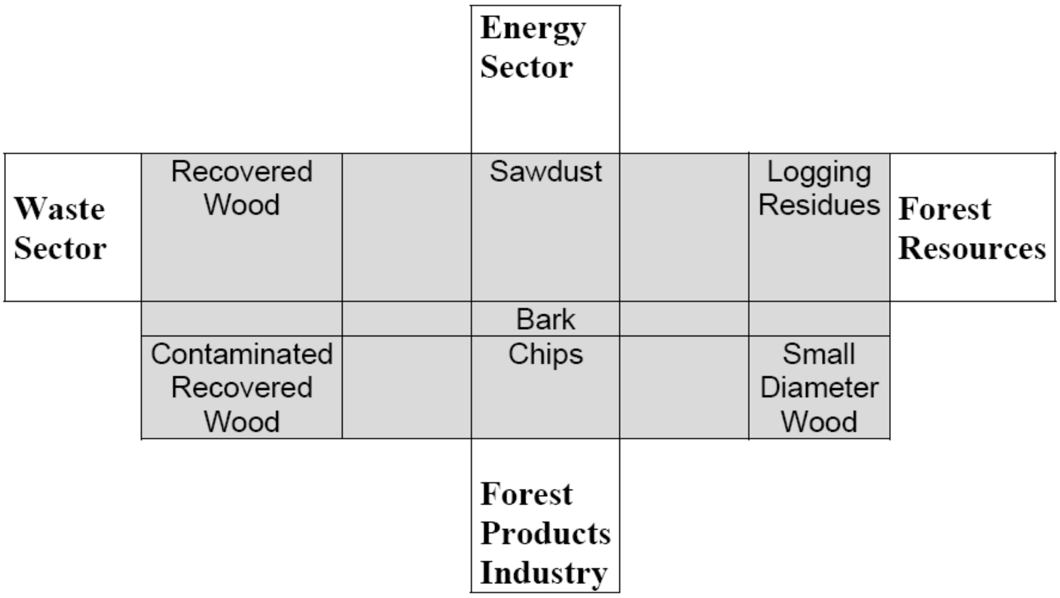

Figure 5 - Wood market actors

Source: EU COST E31 action, 2003[42]

Higher competition among actors could lead to cooperation plans among actors of the same type (such as farmers with farmers, for debating cost in domestic heating) or among different type (such as industry waste and farmers or group of farmers[43]); feasibility is a matter of real willingness, and the challenge of extension advisory services.

There can be anyway strong differences and lack of data from region to region, or from country to country, different tradition and living habits. Differences among remote areas or type of farmers in remote villages of more develop forest market sector (such Finland) are multiplied in countries with economy in transition.

Data on disposal are generally insecure, existing system of organization and control of the use of wood does not function or not completely established, and a serious problem is the much uncontrolled cutting in rural areas.

Western Balkan Countries are a group of countries in transition presenting these features and organizational problems in processing biomasses, affecting actor's behaviour and possibility of cooperation[44]. Going through different countries[45] different problems are met, but in any of them

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[42] *in* Hillring, B. , "Trends and Market Effects of Wood Energy Policies", Department of Bio energy, Swedish University of Agricultural Sciences

[43] e.g. for bio gas or electricity production. See further the case of Kalmari´s farm.

[44] "Regarding biogas, a great number of previously operating biogas [have been closed in latest 15 years]. Several new briquetting plants have been completed but a number of them have been abandoned. The same is the situation with the
plants for agricultural residue utilization and other biomass plants. When the urban waste is concerned, it is still not accepted that it is also a type of biomass, convenient for production of heat."

there is no specific legal framework regulating the use of biomass energy sources for production of heat.
This lead to unbalanced forest exploitation, excessive in some areas but that could be under potential overall and with unsatisfactory growing stock.

Among others, Croatia presents a better utilization and share of wood biomass in the total energy balance, due to the significant share of timber-land in the total government-owned land (44%) and from the 1.8-1.9 million m3 solid (12.1 PJ) of woody residues available for energy production (half of which originates from the wood processing industry, more advanced than other Balkan Countries). However, in the past biomass had never taken an important place in the energy policy of the Republic of Croatia, as it has been utilized by rural population in a large scale for heating and cooking in all Croatian regions; still, in places where the gas grid will not reach, it is expected that wood will remain an important source of energy for heating purposes.

Energy production from energy crops has not been used so far, but there is perspective of establishment intensive plantations of fast-growing broadleaved species[46] on abandoned lands or where agricultural production is not suitable for growing more valuable tree species (estimated 50000 ha).
A satisfactory share in the primary energy consumption would be ensured by extension of researches[47] into forestry goals, to enable maximum biomass production.
"At present, research activities are aimed at identifying the most suitable tree species for short-rotation plantations, [with] resulting average biomass yields typically range from below 1 up to (and exceeding) 20 tons of dry biomass per ha, per year". On average, this would lead to an annual production of 500000 tons of dry biomass cultivated onto the mentioned 50000 ha, equivalent to over 1 million m3s. There is uncertainty if energy crops are going to be cultivated on a relevant scale, since assessments of the logistics and the economics of actual energy plantations in Croatia are minimal.

However, considering currently state-of-the-art in the biomass use for energy purpose in Balkan Countries, some general highlight can be hint; as such some recommendations[48].

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see: project “Accelerating the cost-competitive biomass use for energy purposes in the Western Balkan Countries” funded by the European Commission under Sixth Framework Programme 2002-2006, *call* FP6-2002-INCO-WBC/SSA-3.
[45] Albania and former Jugoslavia. *ibid.*
[46] Willows, poplars, silver birch, alders.
[47] "among the best broadleaved species, as well as the most productive clone or half-sibs" according to, *ibid.*
[48] Black Sea Regional Energy Centre (BSREC). 2006. Acceleration of the cost-competitive Biomass use for energy purposes in the Western Balkan Countries. Specific Support Action, INCO-CT2005-015139. Accent..

About use of biomasses and wood fuel, there are few data[49] on disposal and not easily understandable since they are depending on different climate conditions, living standard, and culture in different regions and locations, as such in countryside and urban livelihoods.

When the types of fuels and combustion technologies for heating purposes are in question, it can be stated that no real evidence exists. In rural areas, mostly wooden chips are used, and in urban concentrations electricity, wooden chips and light oil. This could be used as comparison of the mix of input in considered rural areas of Finland, where extension services in bio energy are operating.

There are then peculiar factors regarding consumption rates and affordable technology. Participation of electricity in consumption is still very high due to the absence of acceptable alternatives; consumption of light oil is decreased significantly due to the increase of its price. About combustion technologies, very different, mostly primitive ones are in use, depending on the rate of development of concrete region, tradition and climate; there is no relevant standardization for the equipment and construction of burning devices; in some undeveloped mountainous regions, primitive home made stoves are in use; there is no organized information about the advantages of modern combustion technologies use; modern imported stoves and heaters are to much expensive for the living standard of average population.
These features suggests hypothesis of extension activities to inform and help in planning for more efficient alternatives, operating in a quite complex area.

On long term, "extension of the university programmes by courses dedicated to utilization of RES: production of chips and densified fuels, efficient combustion technologies etc."[50] are reported as urgent activities; on short term, for faster and propelling results, recommendations could be done about sharing cost between small groups, thus able to afford low cost technologies, cheap and more efficient of traditional ones[51]. Local influencing factors still are considered as fundamental for development of feasible energy strategies, since they can justify among the population a modern approach and testify more economic solutions.
Organization of the dissemination of information about utilization of RES and particularly about the possibilities for biomass utilization is another activity that should be extended; this could improve undertaking studies for assessment of biomass potential and the possibilities for its sustainable utilization.

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[49] "Particularly is difficult the data collection about rural areas.", *ibid.*
[50] *in*: "Accelerating the cost-competitive biomass use for energy purposes in the Western Balkan Countries", project funded by the European Commission under Sixth Framework Programme 2002-2006, FP6-2002-INCO-WBC/SSA-3
[51] An example is small and portable gasificators, using wood chips; an example has been constructed by himself by extensionist Fredrick Ek, with a budget of estimated 200 €.

"Solutions of the countries with positive experience, [such as] Finland, [...] can be applied with the needed accommodation to the local influencing factors. Taking into account the intention of [such countries] to join the EU, some kind of "common" solutions are recommended. Elements of such solutions can be defined through realization of some common projects, supported by [EU]"[52].

[52] *in*: "Accelerating the cost-competitive biomass use for energy purposes in the Western Balkan Countries", project funded by the European Commission under Sixth Framework Programme 2002-2006, FP6-2002-INCO-WBC/SSA-3

2.0 Guidelines in Cooperation

The production and cultivation of agro or forestry energy plant is a matter concerning environment. New Institutional Economics[53] draws a systematic approach and guidelines in environmental cooperation as a *process* of management. In Hagerdon *et alii*[54] (2002) four determinants can design the institutional arrangement to agric-environmental co-ordination; they can be extended in the field of bio energy.

Transaction related to nature or ecosystems (such as impact of harvesting and cultivation of energy crop, leaching of nitrates, management of soil); characteristic of actors involved in the transaction (such as practises and land management); property rights (further of concerning material property they must be extended to values and willingness of certain actions on how to use and purpose of use of the land); changes in property rights is accompanied by governance changes (as the willingness in investing in bio energy is accompanied by prescription of working system, collection of information about best practices and techniques of management, administration strategies at local level, incentives or subsidies at macro scale)[55].

Hence, similarly to property rights, governance structures are differentiated as well; their peculiar features are attributes given by the type of relational process between property rights and governance itself, concerning a characterization of bottom-up (request from farmers) or top-up (driven by upper scale) relation.

Governance structures include: self-organized structures[56] (as co-operatives and networks); governmental regulations (management), decision making on environmental and bio energy policies "(community level, region, province, national, EU, international)"[57].

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[53] Institutional economics focuses on understanding the role of human-made institutions in shaping economic behaviour; New Institutional Economics integrate institutionalism into mainstream neoclassical economics, basing principles from theories of asymmetric and distributed information.
Here´s the definition by: "*International Society for New Institutional Economics*"- http://www.isnie.org/ "The New Institutional Economics (NIE) is an interdisciplinary enterprise combining economics, law, organization theory, political science, sociology and anthropology to understand the institutions of social, political and commercial life. It borrows liberally from various social-science disciplines, but its primary language is economics. Its goal is to explain what institutions are, how they arise, what purposes they serve, how they change and how - if at all – they should be reformed."

[54] Hagerdorn, K.; Arzt, K.; Peters, U. 2002. Theoretical Approaches and Institutional Foundation of Environmental Co-operation, in K. Hagedorn, 2002, Environmental Co-operation and Institutional Change, EE

[55] Extension services are working at this level.

[56] About voluntarily forming community-based associations in sustainable agriculture: OECD, 1998. Co-operative Approaches to Sustainable Agriculture.

[57] *ibid.*

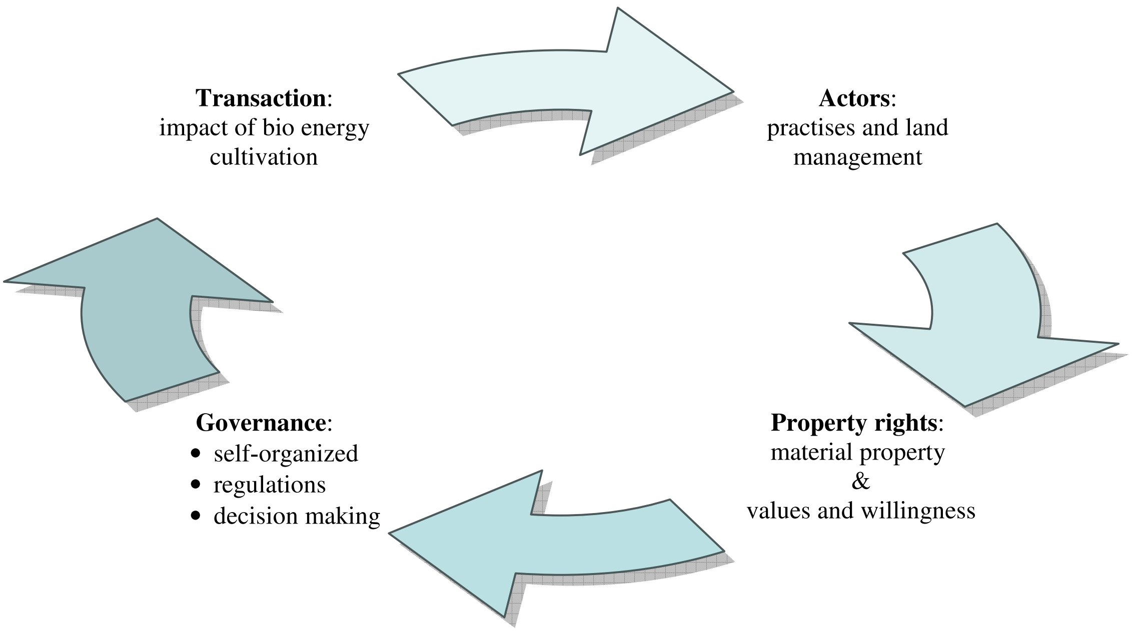

Figure 6 - Arrangement to agric-environmental co-ordination

2.1 Transactions

The impact of bio energy cultivation on nature and ecosystems[58] can be considered by management of land (transaction by farmer and the community concerned) and by which policies are regulating the sector (transaction between the regulator and the farmer).

Environmental impact can be considered as a result of investment in bio energy sector (is there a short term interest/subsidy or a long term perspective[59]? Is the market stable or not? What are forecasts[60]?). Results in coordination and better management can be obtained "If durable investments have been made by the supplier in order to prepare for a long-term relationship between [institutional arrangements and farmers]"[61]. "Recurrent transaction on environment make it easier to invest in specialized governance structures, because the cost can be distributed over

[58] Agricultural crops such as sugar cane, soybean rapeseed and corn are often *water intensive* and pose a number of environmental problems related to land use and soil degradation.

[59] 'Second-generation' bio fuels, favoured by the Commission, are more efficient and less problematic from an environmental viewpoint. These are typically made from agricultural residues and 'woody' sources such as straw, timber, woodchips and manure.
(http://ec.europa.eu/energy/res/legislation/biofuels_consultation_en.htm).
The debate on bio fuels is heating up, with the Commission and the Greens guarding against potential negative impacts such as rainforest depletion in Brazil and increased competition with wood and food production.
About other purposes (such as 'green chemistry' processes), second-generation sources can be turned into high-value products such as bio plastics and other green materials.
(http://www.euractiv.com/en/environment/sustainable-chemistry/article-139332).
But these more energy-efficient bio fuels are still only at the development stage and require bio-refineries to be built up to process this emerging type of feedstock.

[60] For updated discussion about issues shaping bio energy directions, http://biopact.com/

[61] Hagerdon (2002), *ibid.*

many transaction, economies of scale can be made use of and learning by doing over time helps to find more efficient solutions"[62].

It means that the more frequent a transaction, the more interest and need to deal and manage with it.

In agric-environmental transactions, such as different rotation systems and leaching of nitrates, extension services can be a governance structure helping in long term practices to change land management for a better sustainability; it is going to be in bio energy-environmental transaction, as well. Currently the agricultural expert organisation Pro Agria[63] is discussing with the state-owned limited company Motiva for commitment about training and managing energy crop for reduction emissions[64].

Frequency of transaction is an important feature to distinguish and shape level of intervention of an extension service, according to the utilization pattern of the output produced in time[65]. Concerning the impact of agriculture to environment, most of the transactions show high frequency (such as fertilizing with nitrogen). Concerning sustainability, frequency of transactions[66] is a useful characteristic to determine which governance structure should be shaped, considering that "if long agreements are made, [there will be] much lower frequency of decision making"[67].

Uncertainty plays an important role in supply of bio sources for bio fuel and bio energy purposes; it is linked to prices of fossil fuels; to institutional policies promoting new energy market from renewable resources; to the fact that researches onto bio fuels have been, in the first generation of bio fuels, paying the most of attention at economic attraction in short-medium term, without considering a proper energetic balance taking into account an overall of factors to produce bio fuels.

This happened not because researches were ´uncompleted´ or not reliable, but because of political decisions looking for rapid solution in energetic crisis in the supply of fuels in developed countries, decisions those lead to uncertainty of markets[68]. Reduction of uncertainties causes transaction costs,

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[62] *ibid.*

[63] Pro Agria is the leading extension service in agriculture in Finland. The organization defines itself as a "consulting operator which produces opportunities for success for its customers [members and rural entrepreneurs]. *see:* http://www.proagria.fi/english/

[64] Meeting of Pro Agria extensionists in bio energy, Hämeelinna, 27 April 2007.

[65] To say, time pattern of single resource utilization like deforestation is different from seasonal utilization pattern of wheat cropping.

[66] On the example above, deforestation can have different pattern, and actors interests vary according to wood use (e.g. for cultivation; heating; construction, etc.) Frequency of deforestation is different according to the purpose it is done.

[67] Hagedorn (2002).

[68] An increasing literature is pointing out critical reviews about the energetic balance of energy production from biomass, and daily updating are constantly looking for new opportunities and choices. Among others: concerning *wood biomass and tree plantations*:
Patzek, T. W.; Pimentel, D. 2007. Thermodynamics of Energy Production from Biomass", Critical Reviews in Plant Sciences Volume 26, Issue 1

for example for measuring and monitoring bio energy opportunities and gathering adequate information. Extension service Pro Agria works as a reference body in long term perspective of evolution of bio energy sector in local areas, as well as assisting the raise of networks operating in the logistic chain.

It is clear that complexity is characterizing bio energy transaction with environment and markets: indeed, Hagedorn (2002) highlights that complexity "is combined with the still insufficient availability of well-established scientific knowledge, [and] invites actors to practice opportunistic behaviour". The ´opportunistic behaviour´ can be extended to any actor: at macro scale, it can be matched to regulations at national or intra-national level (European, in case of UE) driving the market of bio fuels for inner interest[69]; at local scale, it can be matched to market failure concerning transaction with environment and market, such as illegal deforestation for charcoal production in developing countries[70].

The pattern of environmental and market problems, related to cultivation of bio energy plants, is therefore characterized by attributes of heterogeneity and variability. It is difficult to design strategies and measures for "site and situation specificity"[71] phenomena; therefore the theoretical idea of designing strategies concerning small clusters of farmers in co-operation[72], those can interact with institutions, decrease the heterogeneity of solutions (by the number of groups) and the

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Concerning alternative processes of *corn and sugar cane*, for production of *bio propane* (likely used for heating and transportation): Article: Biopact, 19/04/2007, a new fuel: MIT researchers develop bio propane.
Source http://biopact.com/2007/04/mit-researchers-develop-biopropane-to.html
Bio pact, 19/04/2007. A New Bio fuel: Propane.
source http://www.technologyreview.com/Energy/18551
Concerning alternative bio fuel sources, second generation of bio diesel and investments:
Biopact, 19/04/2007. Finnish oil major is considering jatropha oil for next-generation bio diesel.
source http://biopact.com/2007/04/stat-owned-finnish-oil-major-is.html
Biopact, 18/04/2007. First comprehensive energy balance study reveals cassava is a highly efficient bio fuel feedstock.
source http://biopact.com/2007/04/first-full-energy-balance-study-reveals.html
For an updated articles and reviews about new economical opportunities, researches, and cooperation in the sector between UE and developing countries, *see*: "Biopact: Towards a green energy pact between Europe and Africa", http://biopact.com/
For policies regarding energy sector and related issues, see Euractiv Network: http://www.euractiv.com/
[69] The platform for bio energy by FAO has just begun to be implemented, with the aim of unifying studies and criteria of choices in sustainable production of bio sources for bio fuel.
[70] The umpteenth case: Article: 05/09/2007, Kenya Times. Kenya, massive destruction of acacia trees. http://www.timesnews.co.ke/05sep06/editorials/edtorial1.html
[71] Hagedorn, 2002, in a contest referred generally to agriculture and environment.
[72] Related to agriculture and environment, see the survey made at Environmental Cooperatives in Netherlands, concerning non-marketable attributes with properties of non-rivalry and non-excludability: Slangen, L.H.G.; Polman, N.B.P. 2002. Environmental Co-operatives: a New Institutional Arrangement of Farmers, in Hagedorn, 2002, Environmental Co-operation and Institutional Change, EE.

transaction costs of uncertainty by common and shared aim (such as independent self-production of energy for heating and/or electrification)[73].

[73] The extension service would be advising solutions at cluster of farmers, rather than single ones. This is already a fact, since the farmers chose a common date for meeting with the service in order to share the cost of consulting.
In case of co-operation feasibility, they would have the possibility of turning small portions of land into little economies of scale.

2.2 Characteristic of actors

Distinction between properties of the transactions and characteristics of the actors could be blurred, because decisions of the actors related to the environment are simultaneously influenced by what they are doing. The values and beliefs of the farmers and their attitudes of bio energy issues are relevant, concerning collaboration with other farmers and actors (such as the extension service) and to comply with co-operation rules and policy measures. Their values have an influence on how they evaluate situations; specifically, they are of importance for reliability and stability in networking solutions.

It is possible to stimulate agric-environmental strategies in bio energy, like self-organized coordination, by acting on information capacity, feasibility of access to network and bargaining power (as in buying-selling cooperative); or by enforcing political demand. Extension services can work on these variables, and the efficiency depends on the organisation of the service.
In Sweden the Rural Economy and Agricultural Societies is an independent members[74]' organisations with core business focused on "enhancing an enterprising spirit in rural areas"[75] and promoting a healthy environment in the country as well as in the cities. They initiated the first cooperatives in the country, and the unity of members let the organization interact with the Ministry of Agriculture; through the extension service is thus possible to establish a channel for delegating group of enforcement.

Economic incentives[76] can be usefully effective if there is a pattern for long term purposes and the perspective to not maintain subsided the goal; if not, there are risk of instability on the market (farmers could be propelled in choices not sustainable in time), diseconomy (after a subsidy become felt as normal, as a right, it will be more and more difficult and unpopular to remove it) or opportunism by beneficiaries (such as benefiting subsidies for plots they could not use intensively anyhow; or subsidies for a specific use of land/resources, then used in a more valuable way[77]). Function of extension services could be identified for correcting asymmetric information[78] of actors in agric-environmental decision making; an hypothesis to achieve this is when the services should be an independent third part body between farmers and policy makers, but it is anyway a

[74] Originally farmers, now members are different type of stakeholders in rural areas. The organization has extended the original concept of agricultural development to rural development.
[75] Like the "Rural Economy and Agricultural Societies", operating in Sweden since 1791. http://www.hush.se/
[76] In the cooperate sense, *incentive theory* states that structure compensation should be structured in such a way that the employees' goals (farmers) are aligned with owners' goals (policy makers for society).
[77] Such as plantation for wood fuel production, then used for construction due to higher value in the market rather than wood fuel.
[78] Difficulties raised under conditions of incomplete and asymmetric information when a principal hires an agent, are discussed by the *principal-agent problem.*

blurred concept between the meaning of ´independency´ related to the specific semantic area, and the meaning of the extension service itself.

For example, concerning the Rural Economy and Agricultural Societies, they are liberal expression of the interest of farmers, originally created by farmers themselves. The service was creating with a cooperative spirit of putting together knowledge and consulting for better agricultural solutions and businesses; at the same time they can easier obtain attention by policy makers (Ministry of Agriculture), but there could be lack of control on temptation of opportunism[79] in gained benefit. As case, when extension service Pro Agria, Finland, found farmers gaining subsidies illegally, cannot bring any coercive measure[80].

Anyway, the task of forming institutions (such as self-organising cooperatives) dealing with new problems which arise from changes in agricultural structures and measures, could find proper assumption extension services expressing *necessarily even* the needs of farmers as active members. Considering that "the social environment and embeddedness of actors affect their behaviour" (Hagedorn, 2002), the social form of an extension service could be shaped by community attributes relevant to behavioural norms (such as trust, sense of environmental opportunity and prevention, entrepreneurial values and goals); to the level and nature of common understanding among participants; to the extent of similar preferences in the living community (other actors in the rural community); to the distribution of resources (property rights and/or community rights and policies).

Hagedorn states that when set of values and interaction between complex arrangements are shared among appropriators of a common-pool resource, there is a greater probability of developing adequate rules and norms to manage resources.
This principle can be applied to extension services, as an expression of farmers´ set of values, with functions of consulting and advising for interaction between the needs of farmers and national goals and market opportunities; as well, it can be extended to self-organised network or cooperative systems, those could be thought as smaller clusters at a smaller level, expression of few farmers´ set of aims, with function of better management.

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[79] About "Farmers Cooperatives and Trust", *see* the report by Karin Hakelius, Swedish University of Agricultural Sciences - Uppsala, at *IAMA, International Food and Agribusiness Management Association* - http://www.ifama.org/
[80] Interview to F.Ek, Pro Agria extensionist.

2.3 Property Rights

Property rights is the attribute determining how a resource is used; thus is not referring necessarily to material property such ownership of a land, but to who is in charge of exploiting rights of use. Actors attribute values (positive or negative) because the right holder can be favoured by benefit or burdened by cost components associated to the good. For example, ecological properties, linked to costs and benefits for the use of a resource, can be differentiated according to the result of the definition of the resource itself (impacts of the defined piece of nature on costs and benefits) as well to actions (activities dealing with nature).

Hence, creating and using property rights entails transaction costs, caused by defining the property rights regime, by measuring the environmental properties, and by supervising or controlling the exploitation of the assigned rights.
Therefore, knowledge in land use is the key to understand the pattern of property rights and the pattern in which environmental transactions can take place.

Here, theoretically, can find a place an extension service in bio energy, in order to improve the management of land use for bio energy production and act as a stakeholder relating to upper scale policy makers. What can vary is the nature of the extension body, and the tools used to gather information. Trust is an attribute that is considered by clients when they relate with extension body; trust can be given by competence and reliability. Concerning the type of property rights as private, collective, state, it is possible to defined as well three types of clients relating with extension services for management of bio energy resources: farmers or individuals, the rural community or societies in different municipality or regions, the government. Reliability can be given by the grade of independency of external influence of customers; both can be as well the product of co participation between the different types of clients, being in this case stakeholders.

In this case, extension services can act as a "board" facilitating goals of different type of member and/or clients. Theoretically this is an important feature to manage the forth type of property rights: open access use to resources (in absence of property). In this case, an extension service could identify or co-operate with a not-governmental body or association, in order to preserve a sustainable use of common pool goods[81]. Examples are well suitable in developing countries: setting up of an extension body co-working with an environmental NGO could help in reducing the net exploitation of resources, by introducing better practices, by monitoring the land use in a participatory way, such as 3DPGIS or PGIS, in order to decrease the unsustainability of a process.

[81] such as open accessed forest.

This could be the approach for illegal production of bio fuels - specifically to Africa, ethanol -, in which the two body could co-operate for a long-time aim to endorse value of environmental prevention and for a short-time of satisfying the demand of bio fuel. Participatory methods can be good tools for valuating environmental attributes (land use, type of bio fuel production, type of cultivations, use of end-products, deforestation, and exploitation of the soil) at cost relatively low.

The magnitude of the cost of the transaction for valuating and measuring environmental attribute is an important feature: "[when] prohibitively high, [they can] exceed the benefits [and] property rights for some or even many components of nature may not be established"[82]. Barzel[83] argues that "since in real life property rights are never fully delineated", when "attributes of a good cannot be capture by one individual, nor transferred absolutely by contract" due to the "high measurement and enforcement costs", it is *efficient* to left the attributes in the public domain. Concerning the property rights for of common pool goods, their definition could change as a consequence of technical progress (as pointed by Hagedorn), making decrease the transaction costs of enforcements of rights, measuring and supervising, but the cause can be extended to common management practices, such as participatory methods, *and* co-operative management[84] between the stakeholders consuming the common pool good.

This principle can anyway be assumed for even private and sharing goods, that's the principle of cooperation: "generally the resulting structure of property rights is supposed to be reasonable if the rights related to the differentiated attributes accrue to actors who can influence their design in the most efficient way", and this a condition which is easier to be reached it the attributes given to bio energy crops (such as possibility of bigger incomes, or cheaper self-consuming purposes) are shared by similar type of actors (comparable plot dimension, comparable purposes and expectations). Extension services could be acting for a result in a new structure of property rights (such as the property rights of a self-organizing co-operative) related to different attributes; it is

[82] Hagedorn (2002).
[83] Barzel, 1989. Economic Analysis of Property Rights, Cambridge University press, p.115
[84] For a monitored ten years case history about the production of biomass in co-operative system for heating and electrification, *see:* Ravindranath, N.H. *et alii,* 2004. Sustainable biomass power for rural India: Case study of biomass gasifier for village electrification. Current Science, Vol. 87 N.7. 10 October 2004.
In this case a plantation for bio energy purpose was planted, thus this is not a common pool good.
The word *and* is stressed because it is not said that a cooperative management, in general, will prevent from the exploitation of a common pool good. The case treated: R.Engelhard, Wood Energy Policy Development: Lesson from Kenya (*in* P.Nemetz, Emerging issues in Forest Policy, UBC Press Vancouver) is an example of technical trust failure: the habits and tradition of people in use of the forest were unknown, such that the goal of preventing from deforestation gave completely an opposite result. It's a meaningful example because the management system was not representative of the real stakeholders.
A participatory method for gathering information on land use, where a property rights regime is not clear or imprecise, it's the base for setting up a proper process of management, with more sharply defined transaction costs derived from a clearer pattern of using property rights by different stakeholders.

possible only when the result suits the actors that are when their demand of efficiency and feasibility is satisfied. Indeed, bundling property rights on management of resources means at the same time that the distribution of rights is rather decentralized (as many the number of farmers); "dividing the land users [such as farmers] and other specialized agents automatically results in a higher degree of centralization of those rights that the former holders are deprived of"[85]. To avoid social and political consequence, such as ones due to less identification with the local environment[86], extension services are acting as a specialized agent facilitating change processes making centralized rights acceptable, according to expectation and feasible perspective of management of resources of farmers[87].

In setting up new institution by farmers and other rural actors, an extension service can function as a special actor facilitating self-organisation of group of farmers (clusters), and the coordination among the clusters in a bottom-up structure. This raises the question of what kind of actor should keep the right of organization (that is a control right) of bigger networks producing bio energy; it could be given to special actors (such as the extension service), or to a bigger cooperative managing more clusters, or to a regional agency.

Being the control right an attribute inherent to the structure itself, that is both to the way the different actors are linked (horizontally, e.g. farmer-farmer; vertically, e.g. cooperative-member) and to the dimension of the net of the actors as well, an independent (or co participated by actors) extension service could help in structuring a sustainable centralization of property rights: that is preventing conflict of interest as a mediator and a linkage between actors of different weight and level (vertical-horizontal linkages).
This could be schematized by grouping many clusters of producers (in a bottom-up process), as an interplay between property rights regimes and governance structures.

[85] Hazedorn, 2002.
[86] As with all crops, bio energy crops need to be grown and managed responsibly; incentives such as secure property rights and locally managed externalities should to be in place for sustainable management. *see* International Food Policy Research Institute - www.ifpri.org, *and* publications:
Hazell, Pachauri. Bio energy and Agriculture, IFPRI 2020 Focus n. 14;
Meinzein-Dick, Di Gregorio. Collective Action and Property Rights for Sustainable Development, IFPRI 2020 Focus n. 11
[87] HIR extension approach in Hushålningssälskaperneas förbund, in Sweden, is an extension package program sold to farmers or group of farmers; they can consult the extension service for their entrepreneurial ideas by buying the HIR yearly service; prices depending on dimension of land and other variables (about from 1500 to 5000 euros).

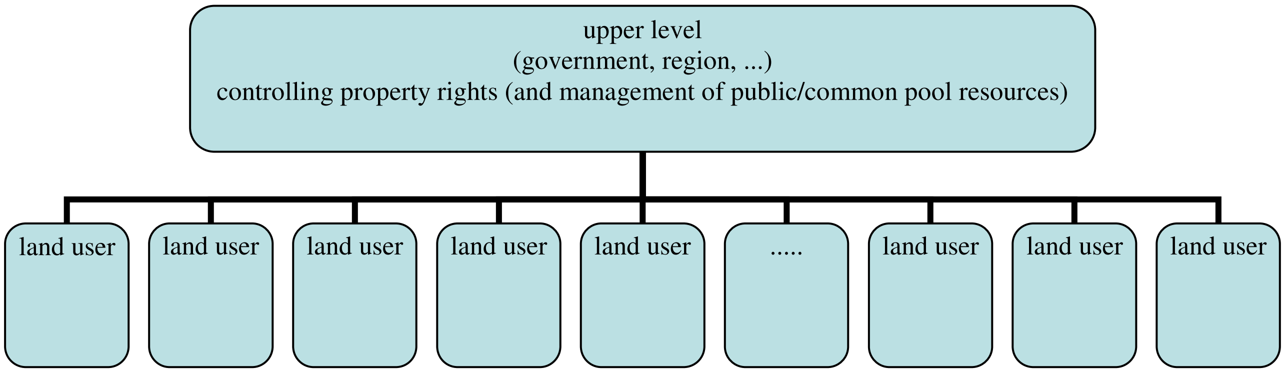

Figure 7 - High decentralization of Property Rights: possibility of loss of identification with local environment and possibilities; control difficulties.

Source: Author

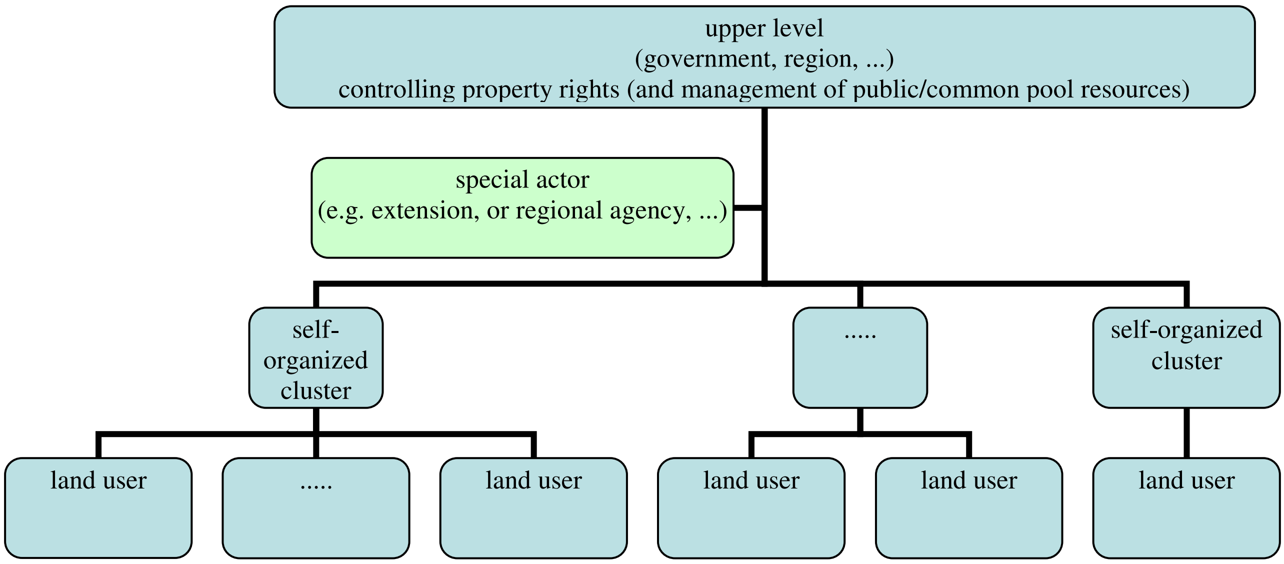

Figure 8 - Centralization of Property Rights with one special actor: higher identification with local environment and individual needs; better embodied needs of local land users. The special actor is facilitating a more structure in property rights.

Source: Author

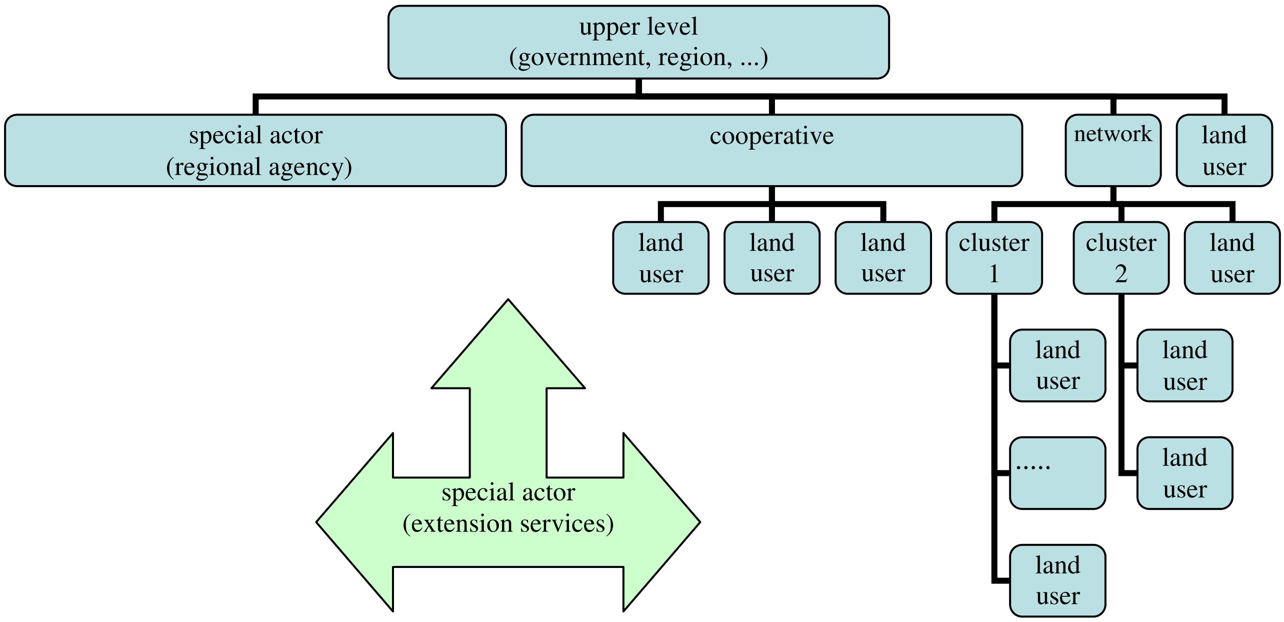

Figure 9 - Centralization of Property Rights in a complex pattern. A special actor as an extension service can facilitate smaller actors to scale up and relate with bigger ones for property rights design and related choices (e.g. type of production, land use management, choices in bio energy resources, improving responsibility of local land users towards community/region goals).

Source: Author

2.4 Governance

Williamson's idea of transaction costs is mainly concerned with the governance of contractual relations. He proposes a three-level schema: governance bracketed by the institutional environment and the individual[88]. *Institutional environment* defines the rules of the game: changes in institutional environment will induce changes in comparative governance costs, leading to a reconfiguration of economic organization.

Individual is characterized by opportunism and self-interest, and human cognition is subject to bounded rationality (i.e., "intendedly rational, but only limitedly so"). *Governance* can be of three structures, called institutional arrangements: markets, hierarchies (or organizations), and hybrids[89].

[88] Williamson, Oliver E., 1996. The Mechanisms of Governance. Oxford, UK, Oxford University Press.
[89] Slangen, Polman, 2002. Environmental Co-operatives: a New Institutional Arrangement of Farmers, *in* Hagedorn, 2002, Environmental Co-operation and Institutional Change, EE.

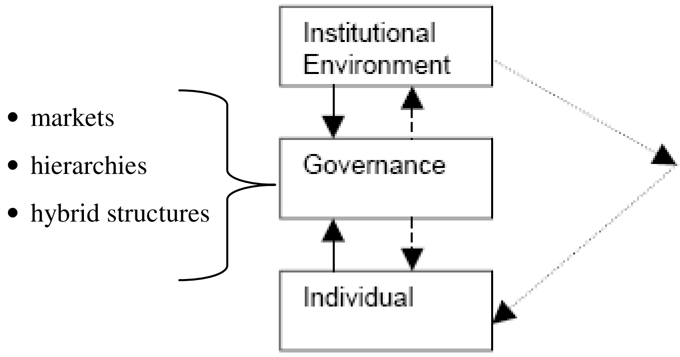

Figure 10 - Williamson's three-level schema of transaction costs

Source: Author

The categories of governance reflect the type of relationship between actors involved in a transaction; the selected action is the subject of the relationship. In markets, the action is based on voluntary bilateral agreements between individuals; in hierarchies, it is compulsory selected by an authority; contractual relations in hybrid structures are defined by a voluntary action before finalizing the contract and a compulsory action when the contract is in force. Therefore, "hybrid forms are characterised by specific combination of market incentives and modalities of co-ordination involving some forms of hierarchical relationship"[90]: co-operation can find place in this structure of governance co-ordination.

Transaction relevant in agric-environment are not only characterised by voluntary or compulsory actions: include activities representing prerequisites or consequences of action selection (Hagedorn 2002). This refers to gathering and processing knowledge and information, measuring, monitoring, organising adjustments and regulating liabilities. Extension services in agriculture, both in Sweden and Finland, includes these functions but regulating liabilities (such as resolution of conflicts); advising services in bio energy, provided by Pro Agria, started in January 2007. Processing knowledge and information uses meeting with farmers and provides membership packages similar to HIR packages by Hush in Sweden. These functions make the concept of governance a comprehensive process: extension can bring the concept of sustainability in bio energy issues.

[90] Ménard 1997, "The Enforcement of Contractual Arrangements", Paper presented at the first conference of ISNIE.
quoted *in ibid.*

To understand what sustainability means for the work inside a comprehensive process, thus based on a network, Abrahamson [91]defined two main characteristics:

1. "Sustainable development is *people-centred* [...]."
2. "Sustainable development is a *normative* concept that embodies standards of judgement and behaviour to be respected as the human community 'the society' seeks to satisfy its needs of survival and well-being".

This definition is used by FAO as a more concrete concept of sustainability for processes in Countries in Transition[92]: "a people-centred concept being conservation-based means to have a close interaction between dynamic human economic systems and dynamic [...] ecological systems [can find expression in maximizing] "simultaneously the *biological* system goals (genetic diversity, resistance, biological productivity), *economic* system goals (satisfaction of basic needs, enhancement of equity, increasing useful goods and services) and *social* system goals (cultural diversity, institutional sustainability, social justice, participation)".

As a consequence, environmental goals, (such as carbon sequestration through bio energy cultivations or promoting bio energy as a renewable source of energy), and their implementation by policy instruments are task that have to be achieved by a regulative idea of sustainability, which requires adequate institutions (Hagedorn 2002). Therefore extension services can facilitate the point stressed by the Commission, those actors in a society should learn to interpret their position as a member of a network[93] (Enquete-Kommission 1998)**.**

The Commission pointed out four strategies concerning the process of sustainability: to *improve reflexivity* and sensitivity among all actors; to *reinforce self-organization and participation***;** for *interest harmonization and conflict regulation***;** for *innovation*.

Extension services can be aligned to these strategies: by supporting "poorly organized groups which are not able to express their interests in the political sphere, e.g. many social and ecological interests"[94] (reinforcing self-organisation; this is the historical *political* aim of the foundation of extension services in Sweden and Finland as well); by providing "possibilities for creative processes of searching and learning in society during the process of achieving sustainable development, [helping as such] to reduce or even to avoid conflicts between the different objectives which constitute sustainability" (strategy for innovation; advising for best practices in

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[91] Abrahammson, K. V. 1997. Paradigms of sustainability. In S. Sörlin, ed. The road towards sustainability. A historical perspective, A sustainable Baltic Region, The Baltic University programme, Uppsala University, pp. 30-35.

[92] http://www.fao.org/regional/SEUR/ceesa/concept.htm

[93] Enquete-Kommission. 1998. Schutz des Menschen und der Umwelt. [*in english*, Protection of Man and Environment] In Procedeenings Conference, Deutschen Bundestages, Konzept Nachhaltigkeit: Leitbild zur Umsetzung (Abschlußbericht).

[94] *ibid.*

agro-forestry and knowledge sharing is the historical *core business* of extension services in Sweden and Finland). The Commission underlines the role of co-operative as an innovative approach to cope with environmental problems on the regional level.

Therefore, this could be the approach with which extension services would work with rural clients (farmers and other land users). As institution, extension services can provide elements such as knowledge and information systems, methods for evaluating environmental damages and benefits, and horizontal non-market co-ordination, such as stimulating co-operation and participation of farmers. These element, co-ordinated with market elements (such as carbon sequestration) and incentives and opportunities to promote innovation can be use for coping for sustainable solution in bio energy, such as the creation of formal and informal network for micro-governance structures of bio energy sources and by-products (such as self-use for heating and/or electrification purposes).

2.5 New scopes of Co-operation

A co-operative system and principle of co-operation cannot solve all argy-environmental problems: if so, co-operative would be superior in a process of institutional competition, and the second and third scheme show that they can be layered in the same level, thus not in superior one; if so, other institutional arrangement outlined would be meaningless.

The question arises as to when co-operatives and co-operation principle will be competitive and preferred to other institutional alternatives. The institutional arrangement outlined as extension service is assumed not be competitive with co-operative arrangement, but as co-working body.
Some situations in which co-operation principle could gain priority among other type of arrangements could be identified.
Concerning to the type of transactions, the transaction cost of policy (such as the cost of administration, monitoring and enforcement) can by lowered by co-operation and participation.
"Centralized management has been fraught with problems [, such as poorly designed regulations, a lack of buy-in by user groups, low levels of compliance] and has in many cases proven ineffective in the promotion of long-term sustainability and ineffective controls on exploitation."[95] Hagedorn (2002) explains this as a top-down approach in problem identification and policy design, in which transaction costs are minimised (less time and resources spent for co-ordination, information,

[95] Hanna, 1998. Co-Management in small scale fisheries: creating effective links among stakeholders, In Proceedings Plenary Presentation at International CBNRM Workshop

dissemination and conflict resolution), but among users, uncertainty is increased about goals about expectations: this encourages short-term actions at the expense of long-term sustainability.
Bruckmeier *et alii* argue that "among the important factors influencing failure or success of co-operatives are: the question of articulation, organization and representation of interests of [land user] and the question of trust between the groups that are usually cooperating in resource management, [land user], governmental administrators and researchers"[96]: this the framework in which extension services can work as a co participated body, delivering research combined with current policies to the land user for best practices and wider solutions of sustainable exploitation of resources (such as wood fuel). As a bottom-up approach, it involves extensive participation by users, giving them a stake in the outcome; uncertainty is reduced, but cost of co-ordination likely increase[97].

Participation and co-operation in environmental and bio energy issues (those could be raised by extension services functions) can be a valid alternative to hierarchical instruments and enforcement, moreover when transparency and visibility are low and there is high cost of supervision[98]. That's a frequent case in Developing Countries or in countries with lack of data about background of consumption of bio energy sources and clear policies (such as wood fuel consumption in Balkan Countries in Transition seen before). Participation and co-operation approaches should be seen in a long term perspective result, since in these contest they would cope with lack of transparency and blurred property rights bonds: they could be a valid approach for better management of illegal production of bio fuel (such as illegal production of bio ethanol in Africa), making the phenomena emerge and building in management tools able to turn in long term the production sustainable.
These systems are always dynamic and with many changes not predictable, thus the management as well: institution more flexible and based on local knowledge and adjusted to local conditions may be solutions more appropriate than only economic approaches, (trying to attribute well-defined values to resources and to balance environmental problems into an optimal stable

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[96] Bruckmeier, K.; Ellegård, A.; Píriz, L. 2005. Fishermen's Interests and Cooperation: Preconditions for Joint Management of Swedish Coastal Fisheries. AMBIO: A Journal of the Human Environment, Vol. 34, No. 2, 5 - Royal Swedish Academy of Sciences
[97] Generally, a weak point in cooperatives as structure of governance is lack of competence in management. *See:* Turner, Taylor, 2003. Applied farm management. Second Edition, Blackwell Science
[98] Crescent literature and interest are pointing the PGIS as a valid approach to integrate community local knowledge with traditional spatial and use-of-land data, even in absence of technical expertise and necessary infrastructure in the often data-poor lower levels of local government.
For sustainable production and consumption patterns in resource use, and use of participatory multi-criteria impact evaluation in renewable technologies in the field of bio energy and zero emissions strategies, *see:* "European Zer-Ind Consortium: Zero Emission Research and Indicators for Integrated Sustainability Assessment" http://www.chim.unisi.it/zerind/

economic solutions) and command-and-conquer policy as well (which regulations could be difficult to respect locally and/or implying a too high cost from central institution[99]).

Co-operatives and participatory methods can contribute to better represent farmers´ interest in undertaking bio energy opportunities.

Specifically to the credit carbon system or zero-emission programs, it is an environmental issue that requires participation of many farms. Knowing the spatial distribution of ecological effects originating from production activities of single farms could be striking for building up a pattern for gaining for capturing externalities in a joint action; this principle could be applied at reduced scale even in joint action between small cluster of farmers sharing needs and resources for bio energy production (such as producing bio fuel or wood fuel for self use).

Concerning the feature of actors, "extension services [can] take the field as a primary unit for working out references and management advice[;] the existence of broader domains of management on the farm may help them to understand the needs felt by farmers when looking for decision support"[100]; therefore extension services, by means of organisation, can systematically contribute to raise up or strengthen trust and credible commitments in a stable way; being trust and credibility resources on co-operative management. Furthermore, extension services can provide" the design of adequate information system inside the farm, [representing] a first way to reduce coordination costs"[101]; as well, they can define alternative systems for managing incentives for a wider array of tasks than a single farmer would be responsible, and they can spread mutual learning as another advantage of cooperation, particularly if the farmers and other land users are in an atmosphere of trust or community participation by means of culture (condition that, if present, could be exploited in projects of rural development for bio energy in Developing Countries).

As Hagedorn (2002) underlines, to make stable and successful a cooperative it is not depending only on the members, but it is "important that other actors and organisations recognize the co-operative as a legitimate partner": extension services can drive a primary role even for a better representation of farmers stake among other stakeholders, and for finding long-term sustainable solutions between policy decision-makers and land users.

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[99] Examples of inefficiency of command-and-conquer policies can be seen in illegal logging phenomena, frequently associated to cases of corruption of officers.

[100] Mazé, A. *et alii,* 2002. The Governance of Quality and Environmental Management Systems in Agriculture: Research Issues and New Challenges, *in* K.Hagedorn, 2002. Environmental Cooperation and Institutional Change, EE

[101] The use of local and detailed knowledge of the land users is an opportunity to reduce the transaction costs of implementation of a co-operation management by increased participation.

3. Mitigation of climate change.

3.1 Bio energy and the Clean Development Mechanism[102]

"The Clean Development Mechanism (CDM) [is an arrangement under the Kyoto Protocol that] aims at reducing greenhouse gas (GHG) emissions, while at the same time taking up CO2 from the atmosphere in vegetation by means of afforestation and reforestation"[103]; rules and modalities for the two options were treated separately by the supervising CDM Executive Board (CDM EB)[104], despite the complementarities of the two options. This is due to many different theoretical and methodological approaches for the enhancement and management of biotic carbon sink (respect on land use, land-use change, modalities of afforestation and reforestation, etc.).

With costs of emission reduction typically much lower in developing countries than in industrialised countries, industrialised countries can comply with their emission reduction targets at much lower cost by receiving credits for emissions reduced in developing countries as long as administration costs are low; however, many CDM projects have led to excessive profits[105]. The CDM is still quite imperfect, mainly because it lacks of a common regulator[106] to police the project

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[102] CDM linkage has been chosen for being an arrangement under UN umbrella, match as well with wood fuel consume issue. Generally, linkages between biomass and climate mitigation can however be acknowledged in projects out of a CDM scheme, or as a positive externality of properties of technological process.
See, for instance, current researches on biopolymers: "Therefore, in the medium to long term, technological progress will therefore most likely lead to higher efficiency gains for bio based polymers than for bio energy production, and as a consequence, this would also result in *higher energy savings and GHG emission reductions*. This has mainly to do with technological progress, the long process chain for bio based polymers (compared to bio energy), and developments in waste management. We therefore conclude that the production and use of bio based polymers offer very interesting opportunities to reduce the utilization of non-renewable energy and to contribute to GHG mitigation."
in: V.Dornburg *et alii,* "Comparing the Land Requirements, Energy Savings, and Greenhouse Gas Emissions Reduction of Bio based Polymers and Bio energy", Journal of Industrial Ecology, 2004, Volume 7, Number 3-4,

[103] Dutschke, M. et alii, 2006. Risks and Chances of Combined Forestry and Biomass Projects under the Clean Development Mechanism, UNEP, CD4CDM Working Paper Series WORKING PAPER NO. 1 Revised June 2006

[104] The CDM EB is under the guidance of the Conference of the Parties (COP/MOP) of the United Nations Framework Convention on Climate Change (UNFCCC).

[105] See recent controversy (February 2007) about loophole concerning cutting off of gas HFC 23:
Article: F.Harvey, February 7, 2007. Billion lost in Kyoto carbon trade loophole, Financial Times
Article: February 7, 2007. Kyoto Protocol 'loophole' has cost $6 billion, New Scientist Environment and Reuters.

[106] Only international institutions with "executive" power seem to be able to drive cut emissions effectively, being regulation not only recommend but mandatory as well (i.e. recently, asked Italy to reduce CO2 quotas to achieve Kyoto Protocol Aims of 6,3%, refusing the national plan for reduction of the emission for 2008-2012.
See: Article, Corriere della Sera, May 16, 2007. *at:*
http://www.corriere.it/Primo_Piano/Economia/2007/05_Maggio/15/emissioni_kyoto.shtml

or to be issued of the credit carbon[107]; it lacks of common standard and indicator, such it would be possible to certify emissions cut off and allow a better risk management in the transaction between the seller and buyer[108].

Linking bio energy project with CDM aim can help reducing transaction cost respect of single-based CDM project, if combined activities are planned and designed simultaneously. The use of wood fuel produced in CDM projects combined with afforestation or reforestation activities has, among advantages: a controlled longer chain of custody (precluding negative externalities that may arise); theoretically, wider project boundaries and less leakage of carbon; compared to single-activity projects, transaction costs are reduced, and even more by contribution of extension services or local official agencies dealing with project development, validation, monitoring and verification costs.

According to criteria "residues-non residues" and "annual-multiannual cultures", Dutschke *et alii* (2006) group bio energy and CDM projects into four subtypes (below), and consider only Type D represent as the one combining activities on mitigation purpose by production of Afforestation/Reforestation and CDM.

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[107] "However many trees planted around the world, we could not keep up with global CO2 output; [...] tree planting is a distraction", F.Sullivan, environment adviser of HSBC, *in* A.Smith, January 29, 2007. Lost in the Forest. Time.
HSBC declares itself as "carbon neutral" bank, in its corporative communication:
http://www.hsbccommittochange.com/environment/what-you-can-do/carbon-dioxide/index.aspx

[108] The price depends on the distribution of risk between seller and buyer. The seller could get a very good price if it agrees to bear the risk that the project's baseline and monitoring methodology is rejected; that the host country rejects the project; that the CDM Executive Board rejects the project; that the project for some reason produces fewer credits than planned; or that the buyer doesn't get CERs at the agreed time if the international transaction log is not in place by then. The seller can usually take these risks only if there is a very reliable counterparty rated by international rating agencies.

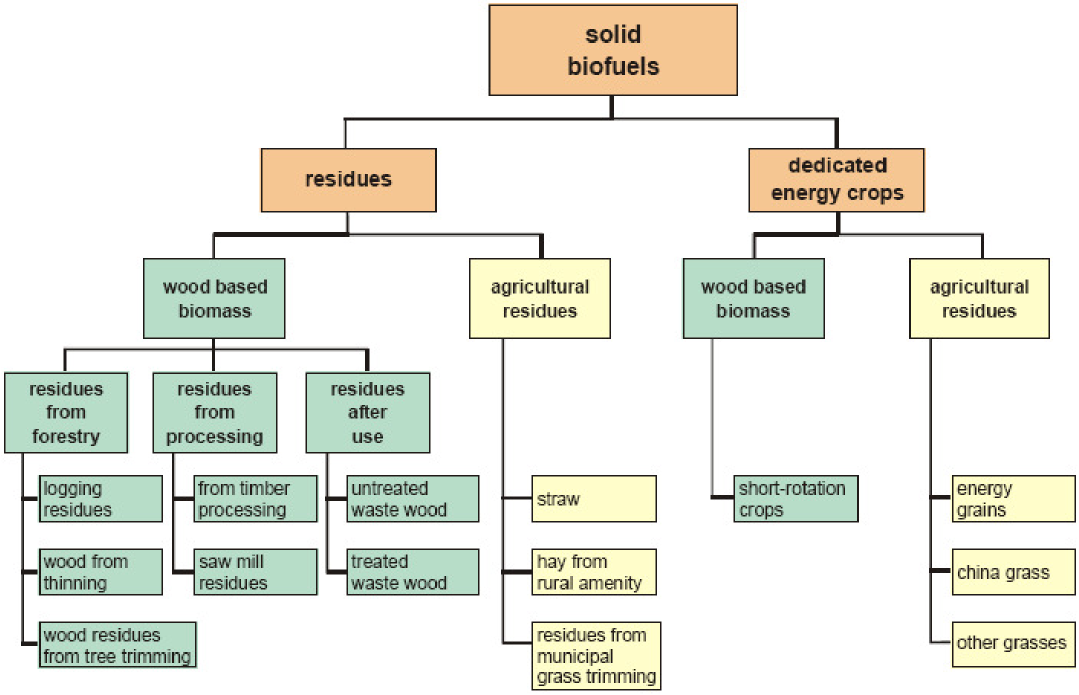

Figure 11 - Types of biomass for solid bio fuels

	Residues	*NOT residues*
Annual regrowth	*Type A* • *Agro-industrial residues, such as bagasse or rice husks*	*Type C* • *Energy crops (e.g. rape-seed)*
No annual regrowth	*Type B* • *Wood residues (e.g. from wood processing)*	*Type D* • *Forest products (e.g. wood pellets)*

Figure 12 - Categories of biomass use for energy production related with CDM project

Source: adapted from Dutschke *et alii* (2006)

Mead (2006) underlines that "in Nordic countries, forest residue use has grown, being underpinned by carbon taxes and research and development", and that integrating forest residue recovery into other forest management operations through large research programmes[109] aimed to reduce costs and health hazards, thus ensure stability. The figure below shows sources and related emissions of greenhouse-gas in 2000 in the world; however, production is not *per se* a mitigation activity, so *type B* and *C* are not considered under CDM boundaries, and CDM projects can be designed inside the *land use* source.

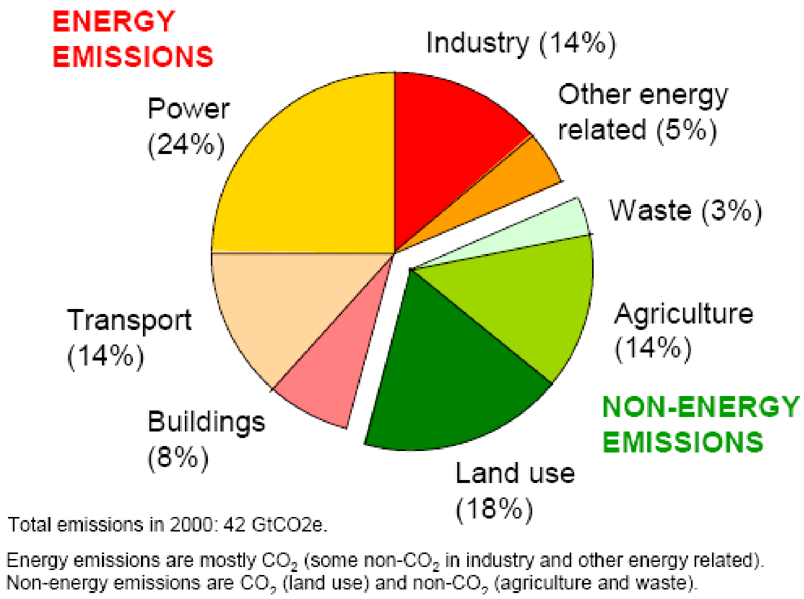

Figure 13 - Greenhouse-gas emissions in 2000, by source

Source: Prepared by Stern Review, from data drawn from World Resources Institute Climate Analysis Indicators Tool (CAIT) on-line database version 3.0. (Stern review, executive summary)

The case of agro-forestry residues could be a fifth type (between C and D), providing a constant income of biomass for bio energy and biomass for sinking Carbon, under certain design. This type could fit the example of cooperatives producing self-heating (and/or electrification) from residual of cropping, such as the case study of Kimito: they would have an indirect effect of climate mitigation as using less fossil oil. Even small cooperative or network can be planned, therefore, according to those "small-scale modalities and procedures specifically intended to reduce transaction costs for CDM project activities below certain emission reduction or carbon removal thresholds"[110].

Extension methods could link official development assistance and help farmers to make the deals between participants in such projects; they could be the useful link to broad access to reliable and

[109] Such covering field as: development of new machinery, transport of the material to the energy plants, drying and storage, quality control, worker health issues, cost reduction for procurement.
[110] M. Dutschke *et alii*(2006)

cheap energy services in developing countries, acting as institution of guarantee between intergovernmental agencies financing project of rural electrification and co-generation[111].

In developing countries, programs based on grid-based power generation, such as producer gas, suffer from incentives for leading research and development to maximize electricity generation potential to serve nearby rural communities (the first) and minimize pollution problems (the latter) [112]. Extension services, if responding to the needs of target community and keeping knowledge on which resources are available, can lead projects to go beyond the view of the current situation. They can drive to choose the appropriate technology adapted to the needs of the target community itself, or to set up a self-organised institution among it, at the same time improving the conversion efficiency from biomass through best practices and feasible plans.

Specifically to the transaction costs related to generation and sale of emission permits, planning and design phase of the project - thus before its start-up - can be extended by such services operating for rural development.

The first proceed from the sale of CERs[113] will have to cover transaction costs only[114], and financing cost for the high upfront share of transaction costs make greenhouse gas reduction projects expect high prices, while credits from afforestation/reforestation for expiring CERs need to be calculated carefully due to yet unclear market signals.

The second component of costs arises from the tasks in the project cycle. Therefore reducing transaction costs in the field of search, contraction, and control, is a task that could be undertaken by extension activities, helping to find an environmental optimum even in small-scale projects.

A small-scale project is defined by two criteria in Decision 19/CP.9 (Annex A, paragraph 1 (i)): "Small-scale afforestation and reforestation project activities under the CDM" are those that are expected to result in net anthropogenic greenhouse gas removals by sinks of *less than 8 kilo tonnes of CO2 per year* and are developed or implemented *by low-income communities and individuals* as determined by the host Party. If a small-scale afforestation or reforestation project activity under

[111] Such as: GEF (http://gefonline.org/home.cfm for database of projects) and GTZ (http://www.gtz.de/en/themen/857.htm)

[112] Concerning biogas production through anaerobic digestion, "China leads the world with 7.5 million household biogas digesters [..] and a network of rural ´biogas service centres´ [extending the] infrastructure necessary to support dissemination, financing and maintenance [to community and farmers]", M. Dutschke *et alii*(2006)

[113] Certified Emissions Reductions: are "certificates" just like a stock. A CER is given by the CDM Executive Board to projects in developing countries to certify they have reduced green house gas emissions by one tonne of carbon dioxide per year. For example, if a project generates energy using wind power instead of burning coal, it can save 50 tonnes of carbon dioxide per year. There it can claim 50 cers (as one CER is equivalent to one tonne of carbon dioxide reduced).

source: Global Environmental Governance, http://www.cseindia.org/programme/geg/cdm_faq.htm#cer
About issuance of CERs in CDM, *see* http://cdm.unfccc.int/Issuance/index.html

[114] Any project with an output inferior to 15 kilotons of CO2 equivalent over its lifetime would be unfeasible under the current condition of the CDM. (*estimated by* Dutschke *et alii,* 2006)

the CDM results in net anthropogenic greenhouse gas removals by sinks greater than 8 kilo tonnes of CO2 per year, the excess removals will not be eligible for the issuance of [CERs]"[115].
Practically, Locatelli and Pedroni[116] estimate the project boundaries between 204 ha for fast-growing species and quick afforestation, up to 3,500 ha for agro forestry systems, further lowered by transaction costs related to CDM project feasibility.

About "arranging funding of certified project activities as necessary", as disposed by Article 12.6 of Kyoto Protocol, micro credits could be a viable path to pay for development assistance and control costs required in combined CDM and bio energy projects. Without a specific fund for small scale projects, micro credit could be an effective tool to finance reduction of transaction costs without subsidizing the projects themselves, in conjunction with reduction of vulnerabilities, education, and concrete project development opportunities identified by extension activities (or local development assistance agencies).

[115] *see:* UNEP, Issued Based Modules Projects. *Stressed* on purpose.
http://svs-unepibmdb.net/?q=node/432&PHPSESSID=41ea3e1ad13d5a68b32e4cd9afffdd3e
[116] *in* Dutschke *et alii* (2006), p. 22

Table 9 - Typology of CDM transaction costs

	Administration costs	**Control costs**
Upfront	Search costs Negotiation costs Approval costs Registration fee	Project Design Document costs Validation costs
During project lifetime	Adaptation levy Project governance	Monitoring Verification & certification

Source: adapted from Dutschke *et alii* (2006)

The idea to join bio energy projects into the CDM scheme is to achieve dual benefits, on climate change mitigation and development in independent local energy supply though a market mechanism (according to the article 12 of Kyoto protocol). However, social sustainable development is an input-intensive and time-consuming process: sustainability and the impact of a project first need to be accepted; then felt and motivating, in order that population will contribute to maintain the scope of the project active, once it will have been concluded.

Criteria for project evaluation and social acceptability[117] for CDM have been discussed by different organisation, trying defining a standard of well practice, thus possible to be guaranteed with a certification system.

The criteria summarized by Dutschke *et alii* (2006)[118] by formulation of different organizations regards: property rights aspects (involvement, no displacement and due compensation of local community & indigenous people; no tenure rights in dispute;); range of activities specific of domain of extensions (stakeholder's information and comments taken into account with grievance resolving; capacity building and training local people); aims of governmental or upper-to-local-level governance (social impacts assessed and mitigated; contribution to poverty alleviation, livelihood improvement, rural economy and employment; respecting health & safety regulations and worker rights).

Therefore, to fill in the "huge gap between theoretical project design and implementation requirements claimed by the scientific community, and the necessary practical requirements for project validation"[119] extension services are in charge of a key role. They act as collector between the R&D; they act as consulting service to relate with for estimations of: the effect of investment

[117] *See* Appendix B for social criteria regarding project design for CDM and bio energy. Institution considered: Forest Stewardship Council (FSC); Climate, Community and Biodiversity (CCB); International Trading Association (IETA) and World Bank (WB); Project Design Document (PPD) of UNFCCC.
[118] *in* Dutschke et alii (2006), p. 47
[119] *ibid.*

on the community/household economy; the compensation between additional incomes provided by afforestation and reforestation project[120] and opportunity costs and labour input.

Extension services could be specifically important where there are no well defined property rights to implement bio energy project with environmental and social effects (typical case for countries in transition): they can correspond to the institutional set-up for spreading knowledge and trust about innovation, thus preventing that benefits will be most likely be absorbed by powerful local authorities (such as the case of project of development promoted without a social consensus or in contest with high risk of corruption) and preventing that local hierarchies will always dominate the knowledge voiced. They can helping for easing and mitigating the change in land use and vegetation type, as well promoting a management and benefit sharing mechanism (self-organized network or cooperatives as such), and therefore improving the projects´ impact on rural livelihoods.

Beneficiaries of CDM projects are characterized by high heterogeneity; the community itself cannot be considered as a unique entity: differences in socio-economic assets (as gender issue, occupation, ethnicity, etc.) and individual utility function among community members makes social cohesion vulnerable. Community, members, families, can be represented as clusters webbed in a network, thus each entity is constantly involved in processes of identification and reorganization.

Multiple actors or subgroup of actors interacting (linked) in a network have multiple interest and perceptions of development priorities; perception and interest depends on information and former knowledge, through which is possible to ´accept´ new information or practices; values responsible of sense trust and reliability on information are given former knowledge and traditions, that is behavioural path lines with which the community system (and/or subgroups) works.

An institutional organisation providing information dissemination, helping to spread it among different subgroups, can therefore improve severely the involvement of representatives from local stakeholders during the design phase, as well as the implementation one[121].

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[120] Project could be extended to agro-forestry residues processing. Cultivation of energy crops are a focus area of extension services as well, but not considered as simultaneously designed on CDM aim, despite they could indirectly contribute in reducing climate change.

The effective contribution is focus of severe critique considering the total amount of energy employed for cultivating energy crops for bio fuel, that could lead to negative environmental transaction costs (unsustainable generation of bio fuel). For a critique review related to tree plantations, *see*:

T. W. Patzek, D. Pimentel, 2007. Thermodynamics of Energy Production from Biomass", Critical Reviews *in* Plant Sciences Volume 26, Issue 1

[121] *Information dissemination* and *involvement of representatives* from local stakeholders during the design phase are clearly highlighted by Mead (2006).

In the 1970s a global fuel wood crisis had been forecasted; one early reaction to the fuel wood crisis was to begin large-scale traditional plantations. Many of these failed to achieve their objectives.

Among problems associated with this almost naught, Mead specifically includes:

Here-hence the project, and before its design, the by project opportunities, could percolate through and catch up community subgroups. Extending opportunities and information can improve dramatically participation.

Indeed, "[the] incorporation of peoples´ knowledge into planning and executing of development program is often very selective and depends on local relation of power [:] to make a decision-making process public does not consequently mean to make democratic"[122]. In other words, "participation does not necessarily include participation of ´weaker parties´, but empowerment of the already powerful within the communities"[123].

Innovative institutional arrangement thus can overcome stressful heterogeneity in groups, with a prerequisite of sharing a common understanding of their situation, opportunities and negative externalities, among people.

Extension services as such are institutions born in Finland and Sweden with the common aim of rural development; they gained trust and have been accredited by members. Still, even if "the farmers of today are able to read, they are educated and they have internet and other ways to find information at their disposal." extension services are working as a "link between the policymakers and the farmers [,] when a strategy is set up on national or EU level. [...] Information about subsidies and requirements is spread in meetings and during visits to farms." MTK and SLC are other " powerful organisations that work in a similar manner but are more strictly following the practice that they work with the well being of the farmers[, but] are not independent bodies like the extension service."[124] Despite extension service can be seen as a "dinosaur from the past"[125] - that

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- Imposing planting plans on local communities rather than implementing community participation programmes. Communication and local ownership of the program is essential for success.
- Ignoring social structural aspects such as: who has the power; who owns the land; who has the main needs; who does the work.
- Large-scale reforestation schemes, often on previous agricultural land, reduced grazing, food production and employment.

Mead point out as well as other causes, those can be summarized in *property rights:*

- Failing to recognize the interrelated nature of rural farming activities by focusing solely on fuel wood plantings.
- Not recognizing fuel wood was only one need of the people, and perhaps not the primary one. Farmers seldom plant solely for fuel wood. This led to poor species choice and other silvicultural practices.

and *empowerment of the local group of power*:

- Ignoring social structural aspects such as: who has the power; who owns the land; who has the main needs; who does the work.

[122] *in* Dutschke et alii (2006)
[123] *ibid.*
[124] Interview through questionnaire administrated to extensionists' meeting in 27th April 2007.
[125] *ibid.*

is, an institution in some cases still working for inertia - if independent[126] it can effectively represent stakeholders´ interests and involve them in a process of change.

Therefore, concerning the issue of common pool of resources (such as environment and landscape deriving from project joining bio energy and CDM), extension service could help developing or putting in practice strategies to manage pools, because operations depends somehow on type of experiences people have had with local organisations: the more they are accredited, the more effect the social capital will have.

Specifically, Stern Review (2007) addressed extension services as a "stamp of approval", able to spur venture capital investment; this type of organisation can promote public-private investment for feasible commercialisation opportunities, addressing local communities with the proper carbon technology, thus reducing the risk of investment and spurring the deployment of new innovations from R&D, once they become cost effective.

3.2 Legal Aspects of CDM projects and consequences.

The country risk is a gradual composite indicator for reliability of a CDM project, since it is a type of foreign direct investment: it depends on “beneficial investment climate”, comprehensive of respected property rights; stable and reliable political regime; enforceable legal title; in force rules on capital export; transparent import tariffs and procedures; tolerable level of corruption.
It is important for long-term investment that these conditions are met to run stable and feasible CDM projects over long periods. In developing countries and countries in transition a "beneficial investment climate" unlikely to be found properly set, hence a proper combination between the scale of afforestation/reforestation the scale of bio energy component should be sized.

There are legal requirement specific to CDM to be respected: "the host country needs to be a participant in the UN Framework Convention on Climate Change, and have ratified the Kyoto Protocol", and " a national forest definition within the threshold ranges of Decision 11/CP.7 (UNFCCC 2001) needs to be determined"[127].

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[126] In this contest, again, *independent* is assumed as synonymous of organization *co participated* by stakeholders of similar interest and attitudes (such as farmers, land users, advisors).
[127] *in* Dutschke *et alii* (2006). The government needs to take into account thresholds concerning the condition of the project area before and during an afforestation or reforestation activity (Decision 11/CP.7), related to the definition of "forest" given by FAO and the country’s FAO inventory practice; then it needs to estimate for the overall A/R project potential over the different climatic and ecological zones of the country.

Two problems shade the operate of Ministries of agriculture and forestry in shaping CDM requirements, making hosting CDM projects a costly task for the host country administration.

First, in the legislative process, the government must *designate* a *national* CDM *authority* (DNA), that can be an independent body. In developing country governments the process could be slow and inefficient: a variety of ministries overlooking the DNA's work could be set up for the fear that the CDM could interfere with sovereignty.
Therefore, the cost of reporting back to inter-ministerial committee can increase dramatically; consequently, recovering this cost from potential investor can be harder. If there are not enough approved CDM projects per year, the effort to set up a DNA will not pay off the commitment period. The effort can be supported (as it is in often situations) by bilateral or multilateral support and cooperation, but specific criteria and guidelines for the project specific to the sustainability defined by host country have to built in to evaluate the project. Furthermore, lack of standard evaluation complicates the process.

Second, there are technical difficulties in economic feasibility in finding suitable thresholds matching FAO's inventory practices and Afforestation/Reforestation potential shaped on specific environmental features of the country. Distinctions of impact made by Dutschke *et alii* (2006) can be summarized per *area size* (a minimum area below 1 ha it will be extremely costly for boundaries A/R definition and monitoring); *eligibility*[128] (difficulties to demonstrate that the land at the moment the project starts is not a forest; very sensitive results of the afforestation/reforestation activities, depending on initial thresholds of what to consider forest); *unclear definition* in Decision 11/CP.7 of "trees", that could be restricted to exclude not woody species.

Concerning size, project typology for combined afforestation/reforestation and bio energy purpose can be grouped in four types, as the table 10 shows:

Table 10 - Combining Afforestation/Reforestation and bio energy: types of project

	Small-scale Afforestation/Reforestation	Large-scale Afforestation/Reforestation
Small-scale bio energy	I	III
Large-scale bio energy	II	IV

Source: Dutschke *et alii* (2006)

[128] *See*: CDM - Executive Board, EB 22 Report Annex 16 page 1. PROCEDURES TO DEFINE THE ELIGIBILITY OF LANDS FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES.

Dutschke *et alii* (2006) give a summary of real cases projects[129] for each of the above. Type I, II, III are currently ongoing and running projects respectively in Guinea, North Vietnam, Moldovan Republic.

The size of type I was suitable to run a participation with an NGO, in the case ESSOR[130]; type III was implemented[131] with grants by World Bank's Prototype Carbon Fund, Government of Japan plus Borrowers, and type IV has been refused by the CDM Executive Board.

Table 11 is here derived to give a reference of the type of some items and the magnitude of some components, referred to the scale of a project.

At a first glance, it is interesting notice that projects granted by international donors resulted tenfold more expensive than projects taking into account local or district scale participants or NGOs.

The interpretation that afforestation/reforestation component at large-scale could end up in a more expensive cost (management and monitoring) in combined projects, due to the up-front financing, instead to ones with small-scale afforestation/reforestation component should be investigated by comparing different real cases.

Stern Review (2007) extends similar consideration to project of *type B* as well (energy crops): " exploitation of conventional biomass on a large scale could lead to problems of competition with agriculture for land and water resources [the highest yielding bio crops being water-intensive and requiring good quality land, thus] depending on crop practices and policies"[132]; this concern agrees with Patzek and Pimentel (2007). Biomass can likely yield carbon savings in the power generation at small-scale if based on CDM thresholds, and savings in industry and building sectors under projects based on residues process (thus not CDM).

However, despite "when used in transport, emissions savings from bio fuel vary from 10-90% compared to petrol depending on the source of bio fuel and production technique used"[133], biomass option based on first generation technology for transport sector is unlikely to be sustainable, for transaction costs (and environmental impact) related to land and water resources exploited for bio

[129] Type I: Guinean village group afforestation & fuel wood generation project idea.
Type II: Community reforestation and co-firing of cement factory in Hoa Binh province, N-Vietnam
Type III: Moldova soil conservation project & municipal district heating system project idea
Type IV: Vallourec & Mannesmann Tubes (V&M do Brasil S.A.) Fuel Switch Project

[130] *See* ESSOR - "Associatión de solidarité internationale", http://www.cyo.com/essor/index.html

[131]For details, *see* The World Bank, at site http://www.worldbank.org
(*Breadcramp*: Home > Countries > Europe and Central Asia > Moldova > Overview)
*link:ht*tp://www.worldbank.org.md/external/projects/main?Projectid=P077763&Type=Overview&theSitePK=302251&pagePK=64283627&menuPK=64282134&piPK=64290415

[132] [132] HM Treasury, 2007. Stern Review on the economics of climate change, p. 227

[133] *ibid.,* p. 228. Stern Review states: " If it is assumed that one-third of biomass was used for transport fuels by 2050, for example, it could meet 10% of road transport fuel demand, compared with 1% now."

fuel mass production. Optimistic forecast could rely on less water-intensive bio crops (such as reed canary grass) and second generation technology, employing biopolymers (basically lignocellulosic materials) for energy production, but still "sustainable and cost effectively [biomass production] will depend on developments in lignocellulosic technology and to what extent marginal and low-quality land is used for growing crops"[134].

Considering social benefits, projects of type I and III (large-scale forestry) give better results. The consumption of wood chips for bio energy purpose is comparable among type I, III and type II, but considered type II project use the quantity in co-firing technology (at 10% of input fuel): for a self-producing and consume purpose in bio energy (only at small-scale energy component) is therefore not feasible.

Small-scale energy projects can end up in saving hot water and electricity depending on the size of the participants. A proper network of households and/or villages, able to be run under CDM combined purposes and thresholds, seems to be feasible in order to provide energy of 1÷3 MW to the town municipality or similar construction or number of households requiring the same amount.
The magnitude of potential carbon credit income is of the same magnitude among project of type I, III and II; but still the latter still will consume a higher quantity of fossil fuel (large-scale energy component).
About environmental benefits, it is interesting to observe that project I and IV required for FSC certificate, likely a small-scale energy component easier to be monitored in the custody chain.
The "CDM-Project over years" component lasts similarly for all the projects, being tied to the time of sustainability of growing-up of trees; still, carbon credits (t CO2 eq.) can be shaped differently in this time.

[134] *ibid.*

Table 11 - Classification of four real cases combining Afforestation/Reforestation and Bio energy components, according to their items.

Item	Reforestation component	Bio energy component
Project Participant	Type I, II (village, villages) Type III, IV (state and municipalities, private)	Type I, III (municipality) Type II, IV (factory)
Project developer	Type I, II (NGO, district authorities/state) Type III, IV (state forest administration)	Type I, III (municipality) Type II, IV (factory)
Size	Type I, II ($\leq 10^3$ ha) Type III, IV ($>10^4$ ha)	Type I, III ($\leq 10^1$ MW) Type II, IV (10^2 MW or production)
CDM-Project over years	15÷30	15÷30
Production/Consumption	Type I, II, III ($\leq 10^4$ m^3/year of round wood) Type IV ($>10^6$ m^3/year of round wood)	Type I, III ($\leq 10^4$ m^3/year of wood chips) Type II, IV (10^4 of wood chips in co-firing, charcoal)
Potential Carbon Credit income	Type I, II ($\leq 10^5$ €) Type III, IV ($>10^6$ €) for the first commitment period	Type I, II, III ($\leq 10^4$ €) Type IV ($>10^6$ €) per year
Social benefits	improve employment among the participant	Type I, III (local resource and job and save hot water and electricity depending on the size of the participants) Type II, IV (none)
Environmental benefits	Type I, IV (FSC certification) Type II, III (soil) + biodiversity, climate protection, recovery of vegetation ecosystem	reduced sulphur emission and climate protection
COSTS[135]	Type I, II (100÷200 €/ha) Type III, II (1000 €/ha, not available[136])	

Source: data evaluated from four cases treated *in* M. Dutschke *et alii*(2006)

135 Rounded at first integer of magnitude.

136 Projects of type IV has been always rejected by CDM Executive Board, cause methodology regarding effective reduce in greenhouses gas emission is not clear.
The data here derived referred to the case of the Vallourec & Mannesmann Tubes, V&M do Brasil, S.A., of which sink carbon methodology is available at: FCDM-NM0104: "V&M do Brasil Renewable Reducing Agent Project" is available at: www.unfccc.int.
The Panel's recommendation ended the V&M attempt "to convince the Panel that its proposal will reduce additional greenhouse gas emissions – and has similar implications for the controversial Plantar project [...]. In reality, the projects would simply mean a license for industrialised countries to pollute – through buying up cheap, and climatically worthless carbon credits – while the companies receive a handsome profit for turning trees into yet more fuel. [...] *In reality these are ill-suited tools for forest restoration which tend to fuel a false sense of security while allowing the root causes of forest loss and climate change to remain unaddressed*."
source: EU Forest Watch, http://www.fern.org/pubs/fw/FW970705.htm, stressed on purpose.

Therefore, from this considerations emerges the idea that small-scale or large-scale afforestation/reforestation combined with small-scale energy project are can be easier to manage and design effectively, participants acting in cooperation with local municipalities or district authorities.
Extension services can function as a role of educators and consultant, as well as cooperating linking local scale needs with the DNA of the country. The function of extension services can be therefore, in some cases, covered up by NGOs; the main criteria is that the body can give a continuous warranty of assistance in the full running of the project, or at least the first commitment period, for a CDM project.
Small-scale energy projects under CDM purpose could be easier to implement and more eligible, could be helped by support of NGOs (as warranty of independent body) contributing for studying feasibly and design, contributing to lower cost.
Scaling-up small-sized energy project into bigger cluster of network could be an eligible solution for saving hot water and energy for cluster of households, therefore centralized municipality.

Dutschke *et alii* (2006) consider that "under micro-economic aspects, it will be advantageous for bio energy projects to develop their resource base by integrating fuel wood plantations, [...] securing a stable fuel wood demand" and thus increasing consumers' purchasing power for the energy produced at the same time; taking into account the role of planted tress for forest, thermodynamic balance[137], and possible negative impact in Developing Countries (Mead, 2007; Patzek & Pimentek, 2007; Engelhard, 1992 [138]), some recommendation can be pointed out.

Extension functions can help avoiding bad externalities of projects not well shaped onto community attitudes, thus reducing environmental transaction costs improving sustainable practices, as well as silvicolture methods could be preferred to manage planted forests[139]. Thermodynamic balance of the plantation can be kept more sustainable for small-scale energy projects[140] (Type I and III).

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[137] "Talk about developing industrial tree plantations for profit in degraded and sterile environments does not seem practical or convincing. Therefore, the new biomass-for-energy plantations will impact disproportionately many of the most important ecosystems on land and in shallow sea water. [...] In order to be profitable, a biomass-for-energy plantation must achieve a consistently high yield of dry wood mass. Trees that grow fast [...] use more water and nutrients than the slower-growing species. Consequently, these fast-growing trees damage soil and their wood is excessively wet after harvest."
Padzek, T.; Pimentel, D. (2007), *in* Critical Reviews in Plant Sciences, Volume 26, Issue I, 2007, p.360
[138] Engelhard, R. 1992. Wood Energy Policy Development: Lesson from Kenya *in* P.Nemetz, Emerging issues in Forest Policy, UBC Press Vancouver
[139] Bio energy is seldom factored into silvicultural prescriptions. *See*: D. Mead, 2006. Forests for Energy and the Role of Planted Trees, Critical Reviews in Plant Sciences, Volume 26 Issue I.
[140] Padzek, T.; Pimentel, D. (2007, *ibid.*) estimate that "the scale and rate of wood processing necessary to replace a substantial fraction of automotive fuel and electricity demand on the earth makes the widespread sun-drying of wood impractical or impossible."

More than attempt to circumvent two different modalities and procedures in a unique assessment for combined projects[141], extension functions can secure the coordination costs for smallholders that accrue to counterbalance the market power of large operators, thus covering the grey area between Type I and III projects; indeed they could manage and coordinate the validation, verification and certification of both project activities (afforestation/reforestation and energy), eventually monitored by use of common resources. The tasks of extension services can thus effectively lead to a decrease in transaction costs, otherwise hardly reached by mere combination of project types.

Extension can secure then the displacement risk that could occur in project of type III (large-scale sized), that is when local communities cannot be directly involved in planning and implementation (the project being participated at upper level): databases concerning land use and management of farmers, thus representing communities pattern, can indeed be provided by extension services[142], which now the profile of each member and affiliated client.
When there is a feedback in trust with the services (being an independent body), extension can be entrust of information dissemination, thus improving a transparent planning process; moreover in developing and in transition countries, information dissemination is a pivotal role, preventing exclusion of minorities or poor households due to possible influence of local authorities seeking to strengthen their position by allocating bigger portions to political friends. The risk derives from informal or unclear use and property rights, hence not depending on project size. Extension services can therefore cover up legal uncertainty of smaller networks negotiating power towards other local or foreign partners. NGOs operating with participatory land-use planning procedures engage in this purpose, but can likely act only on small-size projects.

However, concerning the bio energy component, a clear price structure is still the key for planning a project reacting to real willingness of running it: consumers may indeed benefit from illegal or by-the-law energy access (such as illegal wood fuel logging, logging out of concession, processing plantations for construction instead of designed wood fuel supply, non-enforced energy bills, etc.), so why to pay for goods and services provided by the project? And even so, due to rooted values of environment and climate care, low-income land users may not be able to effort the payment for heat and power of a CDM-energy project.

Under this point of view, despite the raised value of wood biomasses from a CDM, a project is thermodynamically sustainable only when designed on small-scale energy component (at current state of technology) combined with afforestation/reforestation, on purpose to be self-sufficient in auto-consume.
[141] There are three different panels installed by the CDM Executive Board, respectively for assessing: GHG emission reduction, CO2 removal projects, small-scale projects.
[142] NGO acting with the community with participatory methods could provide services useful on purpose.

Solutions like flexible participation arrangements suggested by Dutschke *et alii* (2006) could be set up with household-based metering and adapted payment schemes, those could be combined with micro credit financing; economic feasibility analysis and assessment are functions already provided by extension services. Tester-plots or tester-areas to show off samples of bio energy designed project are the practice to make one have a proof of what he is told about, thus making possible a real interest for new solutions in household economies and residential stability (e.g. enhanced livelihood through rural electrification or shared heating distribution)[143].

Capacity building connected to CDM-energy projects is scale-dependant, being a consequence of households scaling up to villages and communities involved in planning and operation. Developing capacity building process is, as such, scale-dependant, therefore activities of involved bodies and governance institutions should be sized to the expected impact on target beneficiaries.
Extension services organization, where well established as in Finland and Sweden, allow activities to cover demand of households and land users in different district of the country, storing databases, profiling foresight and knowing attitudes of clients; moreover they link national policies and EU target to local rural communities. Property rights are better defined respect to the period in which extension services where created, and now services mainly are consulted for economic assessment, as well deploying information and packages of yearly services. Potentially, they can provide assistance at three type of CDM project raised up by CDM Executive Board (GHG emission reduction, CO2 removal projects, small-scale projects), but still competences must mature up, since bio energy is a new branch set up by Pro Agria in 2007 and experts are mainly middle-aged coming from complementary areas.

NGOs, generally, cannot cover up this role: building up competence in each field of a CDM is a process expensive that rarely a non-governmental body can effort. NGOs can provide assistance where there are no extension services, towards small-size projects and focused areas, and assure assistance in project design and education at all phases and for at least the first commitment period. In larger projects, cooperation between NGOs and extension services is expected to be a good practice (e.g. with the task of flexible participation arrangements for low-income communities): for instance, "for large-scale bio energy installations, importing skilled labour force from outside the project region can lead to the marginalization of local populations".

[143] Demonstration and R&D projects are lesson of experience on R&D co-operation on agriculture, as the CGIAR experience set. CGIAR is an organization of members, partners (national, international and regional organizations, private sector) and international agricultural centers to extend and mobilize agricultural science, promote agricultural growth, reduce poverty, protect the environment and foster equity. For further information, see Stern Review (2007) and the web site: http://www.cgiar.org/
To look up for topic in related CGIAR sites, see: http://search.cgiar.org/search_form.asp

In bilateral or multilateral cooperation, bigger and entrusted NGOs could support clusters of different communities, helping the self-organized outcrop of network for governance of woody biomasses for CDM and bio energy project, as well as the outcrop of services, where still not present, extending land use through education and new opportunities for households economies.

Being a know-how transfer related with changes of entrusted practices and management in rural areas (traditional use of wood fuel, such as direct combustion or charcoal production), change requires a long-term process to bear itself and end effectively up as expected impact; gaining trust and confidence by local community takes time, and project blueprints with pre-approved methodologies could offer incentives for stakeholders to venture into combined projects with proven development benefits.

Despite a lack of certified standards and methodologies in CDM, needed agreement upon minimum sustainability criteria that project have to fulfil, NGOs and Extension services can spin-off policy recommendations of change in land use and land management, and contribute - only if operating in long-term - to face toward devegetation and deforestation. NGOs and micro credit could help fill in the gap of small-scale fund[144] for CDM project planning, as stipulated under Kyoto Protocol Article 12.6[145] but not clearly finalized; NGOs and micro credit could therefore transform the raising in rich countries flows of finance on the scale required in development countries, as urged by Stern review (2007)[146].
Lack of incentives, for combined afforestation/reforestation and bio energy project planning, is currently a matter related to Kyoto Protocol rules and institutions, those characterize design as blurred and economically sensitive; still extending land use and management towards the CDM scheme, underpinning activities with economic assistance and information dissemination[147] is a compulsory step towards climate mitigation.

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[144] "[...] in many places credit may be difficult to come by on a small scale. [...]. In some places, this problem can be circumvented through the formation of farmer cooperatives and other groups. [...] This credit problem may be central in the viability of a bio energy program, and some of the lesson learned in agricultural credit can be usefully studied by the bio energy planner". *Source:* Ramsey, W. 1985. Bio energy and economic development. Planning for biomass energy programs in the third world. Westview Press, Energy Policy Series, Vol. I. No. 1.
[145] Article 12.6 states that the CDM “shall assist in arranging funding of certified project activities as necessary".
[146] HM Treasury, "Stern Review on the economics of climate change", 2007 http://www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/sternreview_index.cfm
[147] Stern Review states that "informal co-ordination as well as formal agreements can boost the effectiveness of investments in innovation around the world" and estimates that "globally, support for energy R&D should at least double, and support for the deployment of new low-carbon technologies should increase up to five-fold. International cooperation on product standards [such as certification by independent bodies and councils] is a powerful way to boost energy efficiency." *Information dissemination* covers a key element (called as *technology cooperation* by the report) of international framework, together with *emission trading,*

4. Methods and organisation of extension methods in rural areas of Finnish Extension.

4.1 Methodology of the survey

The research into needs and perceptions of farmers in remote rural areas of Finland has been limited, according to financial limits and time availability, to some Swedish Finnish Areas, to the documents and reports available in the Pro Agria offices in Helsinki, and benefits of on field surveys and observed meeting coupled with the extensionist Fredrik Ek, working on Bio energy Extension. In charge from January 2007, his role is to help planning bio energy solutions.
During this meeting, observations were focused about communication techniques, composition of auditors, raised interest. External interventions were translated by the extensionist into native language.

4.1.1 Jokoniemi, MTT Centre - 15.03.2007

Visit at MTT Agrifood Research Finland
Object: Sharing knowledge about biomass processing among participants.

Participants at the meeting at MMT centre were: one extensionist by Pro Agria, two team of development working at the centre, farmers interested in biomass processing.

Presentation were made about the consumption of bio energy in Finland, and an overall view of future perspectives, about anaerobic digestion, about economic feasibility of setting up a digester for manure processing and producer gas, about the recovery of clean water from pig sludge and separating the components.

After presentations, a visit to some laboratories took place.
The meeting organized by MMT are made to deliver latter information on issues of interests, and extensionist by Pro Agria was invited as consequence.
MTT Centres are set all around the countryside, under political purpose of "spreading information" around Finland. As consequence, they can be set in very isolated areas, maybe thus affecting the number of participants.

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action to reduce deforestation, adaptation (International funding should also support improved regional information on climate change impacts and research to improve resilience of bio energy plants).

4.1.2 Leppävesi (Jyväskyla) – 29.03.07

Visit at Kalmari´s farm.

Object: Self-producing biogas plant; electrification and heating; automotive bio fuel.

In agriculture the outlook towards biogas plants has changed and the usefulness of anaerobic treatment has become broadly acknowledged, and interest in biogas rose after 1990s. Farmers in Finland are currently waiting for governmental financial support, as is the situation in Germany, although biogas grid and adding biogas into natural gas grid considered about 30 years ago.

In 2000 there were five biogas plants operating in private farms and during 2001 construction was started to create a new type of biogas plant where also the farm's slaughter wastes will be treated. During the recent years there have been and still are big structural changes in the agriculture of Finland.

Farmers' own financial possibilities to make big investments without financial support are extremely small. The role of biogas plant in waste processing and also energy production is understood, but wider application requires wider contribution from the side of municipalities and increase of research and analysis, as well as construction of model plants.

This case show anaerobic treatment of manure and other organic wastes as alternative for waste processing; results are better hygiene, improvement of fertilising value, reduction of odour harms and getting of an economic profit of biogas production, which covers the costs of waste treatment[148].

According to environmental protection regulations, the farms should treat their manure and also pay the costs of treatment; private farmers should calculate the profit according to energy prices they have to pay for oil or electricity. In addition, by anaerobic treatment of the manure, its fertilising value increases and environmental disadvantages decrease.

Kalmari's farm, in Central Finland[149], in the village of Leppävesi, is an example of small scale upgrading system for biogas.

Erkki Kalmari's biogas plant was build by him and his family.

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[148] "Kalmari does not want to reveal that information but the payback time has been very short compared to other farm investments (and also compared to centralized power plants);" payback time was estimated anyway in 5.5 years.
[Interview to Ari Lampinen, 02/04/2007]

[149] For further reading, technical and economical about the plant, see: **Attachment A**

Annually 2000 m³ of the farm's manure and 30 tons of other organic wastes (mainly food industry sugar and fat refuse) are processed at the plant.
The constructions of the biogas plant was started in 1997 and completed in 1998, slurry was led into reactor in started. The process has been developed and optimised for co-digestion: it started by adding bacteria obtained by waste-water plant which uses biogas technology. In 2000 the plant was enlarged so that it would be possible to process organic wastes from outside. Adding organic wastes from outside and utilization of after gas have significantly increased profitability of the plant.

The biogas plant produces all energy needed by the farm; electricity is produced mainly in wintertime. Waste heat of the generator is used for central heating of the farm.
The first aim was to be able to process the slurry coming from the cow shed, which in turn would improve and handling properties as well as produce heat and electricity to be used on the farm. The second one was to develop the plant in order to be able to add other organic waste to the slurry, thus increasing/facilitating the production of biogas.

To run this size biogas plant farmer started with about 80 cows. The manure and urine produced is conducted into the lagoon during the entire year since grazing is not used. Water used in cleaning the shed as well as household waste water is also conducted into the covered lagoon. A pumping rate into reactor is approximately 6 m^3 per day from the mix tank. The hydraulic retention time is 20 days. The temperature in the reactor must be 37°C to run the process smoothly. The biogas production is on average 130 m^3 per day and around 230 m^3 per day when organic waste is added. The annual production of 60 000 m^3 (max 100.000 m3) of biogas is equivalent[150] to 35000 litres of light fuel oil.

Table 12 - Input and Output data of Kalmari's farm in 2000

Input	Output	
40 milk cows	Recovered gas:	0,060 milj. m3
60 young animals	Utilized gas:	0,060 milj. m3
Capacity –Manure 2 000 tn/yr	Electricity produced:	47 MWh
Food industry waste 60 tn/yr	Heat produced:	274 MWh
	Mechanical energy:	19 MWh

Source: brochure distributed at Kalmari´s farm

[150] Assumed a mixture with ~60 % methane.

4.1.3 Liljendal – 29.03.07

Visit at meeting Farmers: Liljendal and Pärnå lantmannagille spring meeting.

Object: Bio energy forum.

At the meeting there were 28 farmers, of which 2 women; estimated age, between 40 and 60 years old. All of them were Swedish Finnish speaking, with Swedish primary spoken language.

The meeting happened in the public auditorium of the village, at 18:00, and registered a low participation with questions or debate.

Farmers were owners of all medium/small farms (tens of hectares). Each farm was supposed to have

access to woody resources, but core business can vary.

After a short introduction by the extensionist of Pro Agria about the topic of this research, but before his presentation about of the state-of-the-art of bio energy in Finland, 25 questionnaires about rural bio energy solutions were distributed.

Aim: to understand their interest about rural bio energy solutions related to the yearly electrical/ heating consumption; their interest in setting up/participating into networks to share benefits between other farmers (farming neighbours) and/or other actors; expected impact of using bio energy in soil impoverishment; general knowledge about affecting law.

The questionnaire was accepted[151] by 12 farmers (fairly below 50%), of which delivered 7[152] but rarely completed in all the questions.

The results however could be considered as an indicative sample among farmers owners of small farms, assuming the south of Finland quite flat and homogenous in availability of resources and education level among the farmers assumed as the same. This single spot survey aimed to be only an example of methodology used, but that well matches the results of *Pellervo Economic Research Institute*[153] about forest owners' willingness to cultivate energy plants.

Questions were chosen to be opened, in order to freely let the farmers express their opinion.

The questionnaire and answers are reported in the next page:

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[151] It has to be said that the farmers were on average "shy" or not well impacted. Happened one case in which an old man refused the questionnaire, after having accepted it, on suggestion by a younger one, probably the son. Generally, there may be the evidence of the more extended is the own land/resources, and likely seeing bio energy as an opportunity; perception of this likely may depend on age and tradition of rural practices.

[152] One considered not reliable.

[153] Bioenergiaa pellolta, Tammikuu 2007 - maa- ja metsätilan omistajien halukkuus viljellä peltobiomassaa. (N.88)

Figure 14 - Questionnaire. Rural Bio energy value perceived in Liljendal meeting

1. What kind of farming are you doing? How many hectares/animals do you have?
2. How do you heat your home and farm today?
    a. What heating system do you use?
    b. How many kWh/s, m^3 of oil or woodchips, do you use for heating your home and farm every year?
    c. What are your annual heating costs?
    d. How much electricity do you use on annual basis?
    e. What are your annual electricity costs?
3. If you are interested in bio energy, what kind of solutions interests you most? (reed canary grass, biogas, wood chips, bio diesel....?)
4. How much of your production capacity you can imagine to use for production of bio energy? (number of hectares, time, existing infrastructure...)
5. Can you imagine yourself making cooperation with farming neighbours about bio energy solutions? (for examples cooperate about biogas plant or a bio diesel plant or harvesting equipment for reed canary grass, or something else...)
6. Can you imagine doing cooperation with other actors in the bio energy area? (for example use waste food oil for bio diesel production, food industry waste for biogas...)
7. How would you share cooperative benefits?
    a. fee on use of consumed energy
    b. by dimension of farm
    c. by quantity of biomass provided
8. What do you expect the extension service[154] to do?
9. What kind of problems do you expect to meet when producing bio energy?
10. How big investments are you ready to do in order to move on to use bio energy/increase your present use of bio energy?
11. What kind of rotation system you use to avoid soil impoverishment? How you think bio energy production could affect it?
12. Are there incentives/law regulations you may benefit/must respect in bio energy production?
13. Your name and contact information?

Source: Author

[154] In Swedish were used the word: Rådgivningen.

Table 13- **Rural Bio energy value perceived in Liljendal meeting**

	Questions #																	
	1			2					3	4	5	6	7	8	9	10	11	12
	crop	*ha.*	*an.*	*a.*	*b.*	*c. (€)*	*d. (kWh)*	*e. (€)*								*(€)*		
1	#	44	0	wood	25 m3	self	18000	#	bio diesel	price binding	n	n	#	#	#	#	#	#
2	grain wood	74 70	0 0	pellet wood	6 t 10 m3	1000	#	#	any	cost effective	n	if economically stable	c	planning	climate, working conditions, harvesting	#	positive	changes yearly
3	dairy farming milk livestock	80	40	wood oil	# 1 m3	self 500	55000	5000	biogas wood chips	40/50 ha	y	y/n	c	information	high prod. costs	#	none	y
4	#	130	0	wood oil	40 m3 6 m3	#	15000	#	wood chips	20 ha	y	n	#	#	get a good economy	#	#	#
5	cereals	300	0	wood oil	# 100 m3	5000 50000	#	10000	wood chips	nothing from the field	y	y	c	d.k.	none	250 000	d.k.	#
6	grain vegetables potatoes	40	#	oil wood electricity	2 m3 self 1500 kWh	3000	1500	800	wood chips	5 ha	n	n	b	none	d.k.	5 000	d.k.	d.k.

Legend

Questions

1. farming; 2. Heating Consume: *a. heating system; b. kWh/s, m3 and type of fuel for heating per year; c. annual heating cost; d. electricity consume per year; e. electricity costs per year*

3. Interest; 4. Production capacity; 5. Coop. /farmers; 6. Coop./ actors; 7. Sharing Benefits: *a. fee on use of consumed energy; b. by dimension of farm; c .by quantity of biomass provided*

8. Extension; 9. Problem; 10. Investment; 11. Soil; 12. Law

Symbols: # = not declared; d.k. = don't know/?

Source: author

4.1.4 Degerby – 11.04.2007

Visit at meeting Farmers: Degerby Lantmannagille

Object: Bio energy forum.

At the meeting there were 8 farmers, of which 0 women; estimated age, between 40 and 60 years old. All of them were Swedish Finnish speaking, with Swedish primary spoken language.

Differently from the experience of Liljendal, the group was much more active; the meeting was made in the little museum Degerby Igor which is specialized on remembrance of Russian invasion during 1944-1956.

The way a meeting is conducted, is highly influencing the attitudes into participation, thus the results in higher interest. Pretty small room, an informal disposition of places instead of the auditorium of Liljendal positively affected the interest of participants with a higher number of questions.

The same questionnaire was administered.

Table 14 - Rural Bio energy value perceived in the meeting in Degerby

	Questions #																	
	1			2					3	4	5	6	7	8	9	10	11	12
	crop	*ha.*	*an.*	*a.*	*b.*	*c. (€)*	*d. (kWh)*	*e. (€)*								*(€)*		
1	#	#	#	oil	3 m3	2000	10000	1400	biogas wood chips	30 ha	y	y	a/c	#	#	#	#	#
2	grain	#	0	coal	30 m3	1000	10000	900	#	#	#	y	a	#	#	d.k.	d.k.	?
3	grain	50	0	wood	50 m3	1000	12000	1000	any	4 ha	y	y	b/c [155]	expert in responsible area	financial	d.k.	change cultivation	y
4	grain	135	0	wood oil	# 20 m3	10000	18000	900	wood chips	5 ha	y	#	c	#	ability of planning	10 000	positively	state
5	#	#	#	electricity oil	5500 kWh 5 m3	3000	5500	700	#	#	#	#	#	#	#	2 000	fallow /	#
6	arable farm	140	#	electricity wood chips oil	6500 kWh 50 m3 6 m3	0 400 2500	6500 0 0	900	bio diesel	400 hours 10 ha	y [156]	y	c	feasibility	planning	10 000	d.k.	d.k.
7	grain	50	0	wood chips	50 m3	600	15000	1500	wood chips	#	y	y	c	feasibility	#	#	#	#
8	#	74	0	electricity oil	10000 kWh 4 m3	2000	#	#	#	5 ha	y	d.k.	#	#	#	#	#	#

Legend

Questions: 1. farming; 2. Heating Consume: *a. heating system; b. kWh/s, m3 and type of fuel for heating per year; c. annual heating cost; d. electricity consume per year; e. electricity costs per year* 3.

3. Interest; 4. Production capacity; 5. Coop. /farmers; 6. Coop./ actors; 7. Sharing Benefits: *a. fee on use of consumed energy; b. by dimension of farm; c .by quantity of biomass provided*

8. Extension; 9. Problem; 10. Investment; 11. Soil; 12. Law

Symbols: # = not declared; d.k. = don't know/?

Source: author

[155] Asked for more info.
[156] in Biogas or Bio diesel

4.1.5 Hamelinna – 27.04.2007

Visit at extensionists' meeting

Object: Guidelines in bio energy extension

The questionnaire in APPENDIX C was administered, concerning following areas:
About the extension service; Expectations in bio energy; Polices and environment; Economic Values & Management; Future Market Expectations and Trends; Bio energy use; Networking and Cut-down opportunities for small farmers / remote rural areas.

Answers to the questionnaire were impossible to gather in the meeting, and they were requested to be delivered through e-mail, despite the risk of loss feedback.
Despite uncompleted questionnaires, contributions from the extensionsts have been an interesting contribution, characterizing this work. Some hinted points of view are quoted in this study.

4.1.6 Kimito – 14.05.2007

Visit at Hagmans farm.

Object: how to make the deals between the participants (the provider and the buyers) of a cooperative project sharing heating through a centralized boiler for straw.

The idea of the Hagmans farm is to use straw in a centralized boiler system, to share heating between 7 buildings: the Hagmans farm, the parents´ and the sisters´ houses, a shop, and two houses behind the school. Extension service required is to estimate the feasibility of the plant.

Estimation was made considering the current prices for heating in the different buildings, and see how much could be the cost of installation (investment) of a system of a centralized straw boiler connected to the household, and the cost of production.

Datasheet is provided separately, a print with real value is available at Appendix C.

It shows that as energetic balance, the system could be sustainable itself (assuming farms can produce the required amount of fuel constantly), but that the cost of investment is rather high (almost 200.000 €). The cost of heating production ends up in 62 €/MWh, that is 81% of cost for heating production from electricity, and over twofold the price of crude oil.

Respect to current total cost for heating, assumed as 100%, the production cost would end up in 167% more expensive.

If all the households were houses, thus choosing for heating from oil option, at current oil price/MWh (assumed as constant in time), the amortization time to make the production cost/MWh balance the oil cost/MWh would end up in 100 years, making the investment unfeasible.

The brief estimation can anyway suggest some hints for developing periurban rural areas. Playing with the datasheet, it is possible to see that if the households using electricity for heating were more (3-4 more), on average at the same distance like the other buildings, and there were building consuming oil on average of a school-type household, the production cost would tend to balance the current costs.

This means that such a system could be considered for planning urban development in rural areas, designing distance connection of the households closer to the boiler (reducing culvert costs).

As example, with such a system, keeping the real heating cost from oil (one house, a school, and a shop), and assuming that there were 9 houses consuming on average 30.000€ of electricity for heating purpose (that is 5 houses added in the real system) at an average distance from the boiler of 100 m, the production cost could fit the current cost (103%), with an amortization time of 15 years.

Similar consideration of network of farms could be done even with other systems, such as a gas producer, depending on purpose of energy use.

At current oil prices such systems are still not an interesting solution from economic private side, but could sound interesting for development in rural areas, by reducing the end-use demand for electricity[157].

Stern Review underlines that "developing new lower emissions technology tends to be a slow process, because it takes time to learn about and develop new technologies"[158]: they needs to be supported by financial investment and education.

Another way that could be undertaken is designing combined different and already available technologies, using renewable resources (not only biomasses) in network for reduced energy consumption.

[157] *See more at:* HM Treasury, 2007. Stern Review on the economics of climate change, *in chapter* 7.2 Past greenhouse-gas emissions and current trends.

[158] *About* inertia in the economy and the difficulty in sustaining a rapid rate of annual emissions cuts, *see:* HM Treasury, 2007. Stern Review on the economics of climate change, p.204

4.2 Willingness to cultivate energy plants

On January 2007 Pellervo Economic Research Institute released a study based on mail survey, consisting of the responses of Finnish private forest owners owning also field in willingness cultivating energy plants. Based on 438 respondents (farmers, entrepreneurs, wage-earners) the study show that results are depending on *gender*, *education*, and *land extension owned*.
Extension services should focus on all of these three features, determining willingness, proclivity for choices. These three aspects can be globally undertaken, since form literature there's evidence in Developing Countries as well, how management of land/resources are depending on traditions bonded to gender, attitudes to education, and sense of property.

In Finland, according to the study mentioned above, 10% respondent plans to cultivate energy plants in the future, with a high uncertainty: almost 50% of the respondents did not have any opinion, and rather less than a half has no plans to cultivate any energy plants in the near future.
On the whole, respondents were found to be more interested in the cultivation of grass-stemmed energy plants than in the cultivation of wood-stemmed energy plants; forest owners are not very interested in utilising fields for short rotation forestry.
Respondents less than 40 years old, and male, were most interested in the cultivation of energy plants, with expectation to improve it in the future, since profitability is expected to improve.

Among attitudes, cultivating energy plants likely suits also part time farming[159] , not only full-time farming.
It's necessary to stress anyway that 50% of the respondents younger than 40 years did not have any opinion concerning this kind of cultivation.

Age of the respondent is thus closely linked with the willingness to cultivate energy plants. The older the field owner is the less interested he or she is in the cultivation of energy plants. Gender affects willingness, too: more than 10% of male respondents would be
interested to cultivate energy crops while only 1% of female respondents were found to be most certainly or certainly willing to cultivate energy crops.
[Two fifth of the respondents believed that the cultivation of energy plants will be profitable business][160], while other fragment could be intended for self-use and self job economic benefit (lower cost in electricity / heating here taken as hypothesis).
[Government is expected to subsidize the cultivation of energy plants also in the future]; with the data of Liljendal and Degerby spot surveys is possible to stress the expectation upon extension services in

[159] 8% of the wage-earners are interested in cultivating energy plants.
[160] Pellervo Economic Research Institute, Working Papers - n.88

information and planning depending on law regulamentation or opportunities, thus matching local interest in cultivations with upper governmental scale.

Popularity is different between the types of energy plants. According to Pellervo Institute there is more interest towards grass-stemmed energy plants (especially reed canary grass) than wood-stemmed energy plants; this interest is not clear in the surveys administrated.
The chapter session discusses about the gathered answers.

4.3 Considerations. Data evaluations and Impact of Extension Services.

From the spot surveys a draft profile emerges, respect to attitudes in cultivation energy plants, land possession/use, and cost of energy per year. Profile matches results provided by *Pellervo Economic Research* about willingness and expectation in these types of cultivation.

Expectations form extensionist services are into planning and giving information, likely synchronizing the willingness of farmers and economic expectations with changes in law and regulation; who didn’t answer or responded "don’t know" about knowledge in legislation regulating the sector, gave the same answer about expectation from extension services.

An answer shows the willingness to have an extensionist expert responsible per area.

It would be interesting to deep through this, and see if there are expectations specifically in helping in raising up networks or cooperatives among farmers (according to their willingness) with a reference in starting up and business planning directly in extensionist services.

A key point is whether regulamentations (with benefits and subsidies) are driving willingness among farmers, or there's a bottom-up request in assistance.

In Finland, Motiva is the state-owned limited company that implements the Finnish government's decisions on energy conservation and produces services to promote energy efficiency and use of renewable energy. To analyse the pattern of the energy consumption and technologies present in rural areas, Motiva is currently commissioning Pro Agria, as extension services, to survey 15.000 farms in three years, with the aim of reach 70% of all the farms in 10 years. Hence extension services started services in bio energy (200/); in the first period they can be consulted free of charge, to allow an expansion of interest in bio energy among land users. Pro Agria extensionist Ari Toivonen explains that "We have started to create the network of operators [research, energy producers, authorities, manufactures and other organizations], which will be the support network for farmers in developing bio energy activities in future[, as well as the support network to the raise of] co-operative operating in the logistic chain [of bio energy sector] (harvesting, transportation, contracts for energy plants)."

Forecast on options of use of biomass for energy production are still too blurred and difficult to estimate. Aside the traditional interest in wood chips, among Finnish farmers the bio diesel production seems to be the current interest for income opportunity, being supported by subsidies of EU. However, bio diesel market in Europe finds difficulties to assure economic sustainability in long term and strong competition[161]: therefore, extensionist services should or not have the responsibility to contribute the improvement such a production?

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[161] *See* Article: Biopact, 26th March 2007. Crisis in European bio diesel industry. http://biopact.com/2007/03/crisis-in-european-biodiesel-industry.html
Constant debates about the matter are daily reported in different economical channels. In the Finnish situation, Pro Agria extensionist Ari Toivonen states that local compressing of oil seeds and the local

Among most relevant problems and interests of farmers are "how to get a good economy", likely with a secondary interest into environment. EU regulamentation and global demand for alternative energetic resources are clearly pushing willingness towards bio energy, but how to get trust from farmers is a long process of change, taking into account search for economic profitability or stability and low propension to investments[162].

Lowering the cost consumption of for heating and electricity through networks sharing the output of renewable resources, thus lowering end-use energy demand, could be a way to investigate deeper in order to: improve the domestic income through saving cost for energy needs; contribute to reduce greenhouses emissions; lower up-front cost of investment through cooperative systems. Systems (and network) made on purpose to sell power to the grid, as in Germany, are of difficult implementation in Finland, due to national energy regulamentation; however, Kalmari´s farm is an example of feasibility for selling gas, that could be reproduced in a network of producers for small-scale farm.

As example, a datasheet[163] for estimating the output of a bio digester with CHP[164] aim has been used, fed with data gathered from the survey. Some assumptions make this model very simple, being the purpose to show that, theoretically, even small input of biomass can run a sufficient energy output for self-consumption per year.

The cost for the construction of such a system (reactor, plus stockroom, plus engine) is not considered, even if it can figure not so attractive among the portfolio of choices that small/medium farmers can do.

The impossibility of storing heat is not considered. Resulting data show only the Total Delta Energy for heating between the available heat and the one used from the running process, considered yearly. Anyway, datasheet can be played around, try to find the optimum in which the heat provided fits the heat needed for each month of the year.

The reactor capacity is assumed to be 110% of the volume of biomass input intended to be used.

It is even assumed that size of CHP system is not a technical bond.

The use of the bio digester is for CHP production, with a power efficiency of 30% and heating efficiency of 55%. The bio mass produced in "hectares for biomass" is used completely as input.

Hectares for biomass for energy production are cultivated with a ratio 4:1 of trifolium and sugar beet; animals are supposed to stay in the farm 200 days per year.

Table is shown below.

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manufacturing of bio diesel (self use) will be increased. Wood and the rest of wood in harvesting will be the most common raw material. Also the share of reed canary grass will grow. Environmentally sustainability of bio diesel is not discussed in this study.

[162] From the surveys, ranging from 70 up to 100 €/ha per farm between 40 and 140 ha; as alternative, an average of 5 ha destined to biomass production (currently relying more on wood chips and grain).

[163] Provided in separated *file*.xls

[164] CHP: *see* Appendix A.

Table 15 - Current needs for energy are considered here as the least output to reach through a bio digester, under restrictive assumptions.

Delta (energy), heating, is the difference between the available heat provided yearly and the own heating needs. Delta (energy), power, is the power production from biomass produced with the CHP system.

Users	Own heating needs (MWh)	Own power needs (MWh)	Type of animals	N. of Animals	Hect ares	Hectares for biomass	Delta (energy) kWh		Eq. cost €	Eq. cost €
						(supposed grass/trifolium + sugar beet, ratio 4:1)	Heating	Power	oil crude, heating	electricity, power
User 1	17	18	none	0	44	5	33379	12405	915	942
User 2	32,42	20	none	0	144	5	17959	10406	492	790
User 3	10,2	55	dairy	40	80	40	447908	224815	12281	17085
User 4	88,4	15	none	0	130	20	126583	107656	3470	8181
User 5	1020	131,5	none	0	300	0	-1020000	- 131500	-27968	-9994
User 6	21,9	15	none	0	40	5	28479	15405	780	1170
User 7	30,6	10	none	0	100	30	276957	172434	7594	13105
User 8	210	10	none	0	140	5	-159621	20406	-4376	1150
User 9	34	12	none	0	50	4	-248356	30406	225	1028
User 10	204	18	none	0	135	5	-153621	12406	-4212	942
User 11	56,5	5,50	none	0	100	5	-6121	24906	-167	1892
User 12	101,7	6,5	none	0	140	10	-134	54311	-4	4127
User 13	34	15	none	0	50	5	16379	15406	449	1170
User 14	50,8	20	none	0	74	5	-421	10406	-11	790

Results from the surveys

green is a supposed value, by comparison between other data from the survey.

Animals are supposed to stay in 200 days per year. Hectares are supposed to be cultivated 1:4 with sugar beet:grass (trifolium)

System supposed to run 100% on CHP

yellow is a data gathered from surveys

orange are data evaluated from surveys

Source: Author

The table 15 shows that theoretically this could be (energetically) a solution to be further investigated, for interesting outputs and equivalent saved costs.

Further, data gathered from the survey are evaluated to calculate the current farms own needs for heating and power, thus calculating the cost; then they are compared with size farms[165], to see if there is any correlation. Where missing, input values are guessworked by comparison with real ones. On average, gathered data have been decently reliable (more for heating cost declared by farmers): evaluated values of heat energy consumption, costs, compared with declared values showed an error in a range of 3-16% on most of cases, reaching 40% in others. These values should not worry to much: estimated values were calculated using

[165] Size considers only the number of hectares.

prices on energy sources provided by Pro Agria, declared values by farmers were clearly rounded, cause in a survey a person tend obviously to give a magnitude of reference in reporting data, and not the exact number.

Even if the number of farmers surveyed is too small to argue a conclusion, the relation between *cost of power per hectare* seems to weigh more on very small farms (around 40 ha), rather than threefold bigger farms (ranging from 100 to 140 ha), with an exception of one land owner. Total cost reflect this trend, since heating cost per hectare highlights a weak relation, likely due to the rigid and prolong winter of Finland.

Considering the mean value of the *power cost per hectare* of the farms up to 80 ha, it end up with a cost of 56 €/ha, that is eightfold the mean value for farms ranging between 100 and 144 ha: 7 €/ha.
It should be interesting to go through this feature, which could be interpreted as a kind of pattern in villages; a cooperation system should take into account this, to balance properly the management.
The table and figure below show these result. For the evaluation of data, the datasheet is available.

Table 16 - Distribution of costs per farm dimension

Users	Own heating needs (MWh)	Own power needs (MWh)	Hectares	Hectares for biomass (supposed grass/trifolium)	Heating Cost	Power cost	Total Cost	Heating cost/ha	power cost/ha	Total cost/ha
					€	€	€			
User 1	17	18	44	5	300	1370	1670	6,8	31,1	38
User 6	21,9	15	40	5	2090	970	3060	52,3	24,3	76,5
User 9	34	12	50	4	800	960	1760	16	19,2	35,2
User 13	34	15	50	5	600	1320	1920	12	26,4	38,4
User 14	50,8	20	74	5	2210	1520	3730	29,9	20,5	50,4
User 3	10,2	55	80	40	520	4590	5110	6,5	57,4	63,9
User 7	30,6	10	100	30	1620	1080	2700	16,2	10,8	27
User 11	56,5	5,50	100	5	2750	560	3310	27,5	5,6	33,1
User 4	88,4	15	130	20	3000	1140	4140	23,1	8,8	31,8
User 10	204	18	135	5	9290	1130	10420	68,8	8,4	77,2
User 8	210	10	140	5	1000	830	1830	7,1	5,9	13,1
User 12	101,7	6,5	140	10	3050	700	3750	21,8	5	26,8
User 2	32,42	20	144	5	970	1520	2490	6,7	10,6	17,3
User 5	1020	131,5	300	0	48450	10000	58450	161,5	33,3	194,8

Mean value *power cost/ha,* [44÷80]: 56,3 €/ha
Mean value *power cost/ha,* [100÷144]: 7,9 €/ha

Results from the surveys
green is a guessworked value, by comparison between other data from the survey.
yellow is a data gathered from surveys
orange are data evaluated from surveys

Source: author. Data evaluated from surveys on field

Figure 15 - **Distribution of costs per farm dimension**

Source: author. Data evaluated from surveys on field

Only considering the *power cost per hectare* as a pivot factor, an idea of running a cooperation system for bio energy solution could result in a network between small plots of field cultivated, as if resulting in bigger plot. A first hypothesis of a network could be cooperation among three or four farms of about 50 ha, sharing 5 hectares for bio energy cultivation for self use, in a CHP system using an input land size of 20 ha, or in a system making use of bio crop for selling gas (like Kalmari´s farm).

Concerning heating purpose, the results of Kimito seems not be promising, for the high cost for plugging farms with culverts, or likely certain type of network required heating and power consumption of a magnitude of a municipality to be properly run.

Anyway, it still could be valuable to deeper investigate the relation between cost and farm size for a cooperating network, even on the side of number of animals. In areas undergoing transition or informal economies, a cooperative system as such could better manage resources otherwise wasted[166]. Therefore, economic benefits of self production of electricity, environmental impact[167] and environmental policy impacts should be investigated as such.

About expectation and capacity building in bio energy solution among Finnish farmers, as expected wood chips benefit quite an interest, due to high availability and easy access to this resource. Likely, extension services should help in planning and giving information on how to increase energetic efficiency from this resource, to better exploit it.

VTT[168], Technical Research Centre in Finland, is going through the research and application of technologies with high impact in the environment and energy efficiency. Specifically, VTT's site report: "Energy economy, energy transfer and storage as well as effective use of energy and management of emissions are also an essential part of our research. Our services and expertise cover all parties involved in the energy value chain"; it seems as VTT is providing services in extensions in energy economy and supply chain, but likely farmers with interest in bio energy solutions requiring investments of the magnitude of thousands of euros difficultly could refer to the institute as clients.

Extensionist services try to identify low cost solutions with a good efficiency, bridging information from Research institutes. Likely on this purpose, in 2007 Pro Agria starts to make survey as well, according to directives of Motiva

About the willingness to cooperate, in the first survey it seems bigger owners likely more interested in cooperating between them, with a management system assuring benefits from dimension of farm or biomass provided, and not with a system based on a fee on energy consumed.

The preferred system to grant benefits anyway relies on quantity of biomass provided; thus, it could be tricky thinking on a cooperative system of mixed type of energy plants or sources, being features of cultivars and energy output very different.

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[166] See the case of Moldova discussed in conclusion chapter: the excess of manure is illegally placed nearby villages, ending up with polluting wells. (*source:* Gulca, V. 2007. Personal Communication).

[167] University of Jyväskylä analysed the pathogen content of the fermentation process in Kalmari´s digester, and compared it to the untreated cow sludge. Results were a reduction of almost 100% of pathogen bacteria. Kalmari´s farm represents a case of bottom-up impact in institutional, political pattern and scientific interest, regarding:

- implementing a cost-effective self-producing electricity and heating facility, at small scale;
- independency from economic subsidies;
- decentralized energy production competing with government owned centralized energy companies.

For an analysis of extension activity and impact of the case of Kalmari´s farm, *see* Appendix A.

[168] VTT Technical Research Centre of Finland is the biggest contract research organisation in Northern Europe. VTT provides high-end technology solutions and innovation services; [it] can combine different technologies, create new innovations and a substantial range of world class technologies and applied research services thus improving its clients' competitiveness and competence. Through its international scientific and technology network, VTT can produce information, upgrade technology knowledge, and create business intelligence and value added to its stakeholders. [*source*: site: http://www.vtt.fi/]

Among farmers' attitudes, this choice could underline a set of economic values tending more towards entrepreneurship for increasing profits, rather than lowering cost of production, another bond for running a cooperative system.

Small owners can't figure out a system of cooperative between farmers for bio energy solutions.

Generally, there is scepticism about cooperating with other actors (e.g. industries, or plants); only bigger owners can figure it out, or already users of processed biomasses (such as biogas) could do it.

There is a difference anyway in the two spot surveys: assuming farmers of same educational level, same age and average dimension of land[169], possibility of figuring out a cooperation system between other farmers was more diffuse in the Degerby survey, not only for answer reported in record 5, but even for observed participation of people. A possible explanation is the small group and the way the extension activity was conducted: a "familiar" condition in which the extensionist is perceived as "the own reference" likely increase interest and encourage in doing question on a brand new topic, of which knowledge of participant is low or not deep enough to be effective in decision making for feasible solutions.

[169] Data evidence three type of dimension: from about 50 to 70 ha, a double of this size (around 140 ha), and again double of this size (300 ha).

4.4 Networks of cooperation in the field of Bio energy

Co-operative, as institutional solution coping with agro-environmental problems, refers to an "arrangement that structure an external relationship for resource governance between relevant stakeholders"[170]; a particular focus has been set even by World bank[171] in participatory approaches in developing countries, approaches used to describe the role of co-operative and the concept of co-management. By an institutional point of view, co-operation is an organization that can be extended between stakeholders with different internal organization structures, thus with different set of characteristic.

Generally the concept is "not tightly defined, and can be used for a variety of institutional arrangement ranging from mere consultation to the devolution of decision-making authority"[172]; considering that there are trade-offs between different ecological, economic and social objectives set by the variety of stakeholders structuring a co-management organisation, to judge the efficiency one should know the society's preferences regarding this objectives and trade-offs. With Arrow's impossibility theorem[173], Birner *et alii* (2002) explain that, being impossible to determine the *social welfare function* satisfying the set of preferences with a single global societal preference order, it is no possible to determine the most efficient co-management arrangement.

Improperly but intuitively, it could be assumed that it is impossible to determine the optimum efficiency of co-management because "there is too much uncertainness about type of characteristics, criteria and objectives of stakeholders members of the organisation".
The best option seems to be still the learning by doing that is making comparative evaluations of different arrangements with regard to specified objectives. Under this perspective, a co-management arrangement is considered as a relational contract structuring the relationship between parties in a long term perspective. The contracting parties can be local residents, land users and farmers, as well NGOs, agencies, as well as extension services or business organisations.

The farmers and local residents require some type of co-operative organisation to be able to become a contracting[174] party to a co-management agreement: the agreement is therefore a relational contract in which it is possible to apply the concept of governance, based on transaction cost economics (Williamson) described before, in which extension services can take place[175].

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[170] About co-management, Townsend and Pooley (1995), *in* Birner, R. et alii, 2002. Coping with co-management: a Framework for Analysing the Co-operation between State and Farmers´ Organisations in Protected Area Management, *in K.Hagedorn,* Environmental Co-operation and Institutional Change, EE.
[171] World Bank (1996), "The World Bank Participation Sourcebook", Washington, DC: The World Bank.
[172] Borrini-Fyerabend (1996, pp. 3, 12) *in* R.Birner *et alii*, (2002).
[173] Arrow's impossibility theorem: In voting systems, no voting system based on ranked preferences can possibly meet a certain set of reasonable criteria when there are three or more options to choose from (criteria of: unrestricted domain, non-imposition, non-dictatorship, monotonicity, and independence of irrelevant alternatives).
[174] It does not imply a formal contract on legal basis: contracting can be informal as well.
[175] Co-management arrangements in bio energy can refer to different type of transactions, such as harvesting forest resources, illegal logging for wood fuel production, use of fertilizer for production of energy plants, property rights, etc.

Among same type of stakeholders (like among farmers), co-management can find expression as a formal arrangement based on co-operation.
As a business organisation, co-operation can be "capitalized, managed [and controlled by] its members patrons [to provide services and/or goods for] its member patrons at cost"[176].
The principle is that farmers as members can sell or buy their inputs through cooperative.
In a network operating in the field of bio energy, this could be sharing the produced inputs for bio energy purposes, such as wood fuel, manure, or reed canary grass harvest.

There could be different models of how the output produced could be shared. Cramer (1997) defines the profit through the cooperative as *net savings* the patronage dividends, returned "to the member-patrons in proportion to their business transactions with the cooperative". In the case of bio energy networks, in the questionnaire administrated to the farmers in meeting of Liljendal and Digerby, there were three hypotheses about the membership for using the output of the cooperative.
The first, to make the benefit correspond to a fee on use of consumed energy produced via the cooperative system; in such way, anybody will pay a fee independently of their production or harvest, and the idea is to balance input potentiality and disequilibrium of producing factor among farmers.
The second, to share the right of use the output by dimension of farm; in this case, the cooperative is supposed to put more weight to major producers: the more one produce, the more one can get.
The third case is sharing benefit by quantity of biomass provided: this case is still based on the principle of the more produced, the more obtained, but it is underlining the quantity effectively produced.

Being an indicative survey asking about disposition of farmers, the hypothesis did not go through balancing the system of management.
Consideration about values of different type of biomasses and cost of production has to be done, since in the hypothesis of a network of producers of different biomasses (such as wood fuel, reed canary grass, or manure), farmer will face different cost for heating and electricity in the production of their farms.
The simple model suggested, if taken into reality, clearly has to find the agreement of farmers to rise up cooperative networks. Likely, it could be done easier with farmer producing the same type of biomass. About the answers given by farmers at the meeting, there is anyway a large agreement in possibility of upraise cooperative system under the third hypothesis, sharing benefits by quantity of biomass produced. This agree with main principle "upon which the co-operative movement based its organisation", highlighted by Turner[177] (2003): "any money surplus generated during a trading year may be returned to the member in proportion to the amount of business they have done with the co-operative in that year, or could be retained and added to general-reserves, or retained and allocated to members".

[176] Cramer et Alii, "Agricultural Economics and Agribusiness", Seventh Edition, Wiley.
[177] Turner, Taylor, 2003. Applied farm management. Second Edition, Blackwell Science.

There are thus two types of rights (Polman, Slangen, 2002)[178] describing the constitution of a co-operative: the allocation of *control rights* (votes) about choices and administration of the cooperative itself; and the allocation of *income rights* (shares).
Extension services can help in planning the proper allocation of shares and designing the co-operative system[179].

About network of biomass producers for self-consuming purpose, particular attention is given to the values and cost of biomasses produced; by prices on the market of biomasses and substituted products; by prices of electricity; and by willingness of farmers in cultivations and management.
If prices of electricity are high[180], or the cost to access to the electricity grid to expensive to be a producer, likely the cooperative would be mainly oriented to self-producing heating (and/or electricity) rather than entering into the market as a seller. This will affect more the interest of small farmers, since likely large farms could be less attracted by not market opportunities and have more options to use produced biomass for self purposes. Therefore, the idea of cooperation for self use in heating and/or electrical purpose could interest small/medium farmers, in order to spread options of use land (smaller pieces of land put together).
In this configuration, network is producing with the goal of allocating an optimized quantity of biomass to members; energy output will be as well allocated, if the processing plant is shared or available for each members: this happen for wood fuel consumption (used practically always still[181] for heating in burning in place) or for centralized plant[182].

The type of cooperative that network in bio energy could be mainly for production and services. Essentially farmers worked together to optimized or increase possible output production of biomass, otherwise not viable by single units. They could afford this aim through choosing same cultivation for small part of their own fields, resulting in a bigger one; by "sharing men, machinery, and knowledge"; specific help would be provided by extensionist services. The services provided to members are heating, derived from an increased amount of biomass, and/or electrification if the network disposes of a processing plant. Marketing purposes can be raised up only if a sufficient production can be reached to be competitive. Kalmari´s farm is a matter, and a network could be look through it as a goal. Kalmari´s farm is able to combine self service use in biogas production from manure and other mixed input, store it and sell it to the market as fuel.
Members of a marketing and storage cooperative could operate a pool system on which cultivation choose, with extensionist giving consulting about which could be more convenient to harvest. According to Turner

[178] Polman N.B.P, Slangen L.H.G."Self-organising and self-governing of Environmental Co-operatives: Design Principles", in "Environmental Co-operation and Institutional Change", EE, 2002.
[179] Visit with extensionist F.Ek. to Kimito, Requested assistance for designing and planning for a co-operative providing heating for households from a centralized plant processing straw.
[180] Could be the case of cabling a remote household.
[181] According to Extensionist Fredrik Ek, use of wood fuel for biogas production could raise in medium-long term.
[182] Like Biovakka Oy.

(2003), this model is abundant because farmers, less skilled at marketing, are more favourable to ask for management.

Small networks could easily accomplish other important principles of cooperation (such as one man, one vote and open membership), and turn the management easier. Competition cannot be forced when cooperative is not market-oriented (e.g. oriented to self-use production), and financing needs may benefit from feasibility consulting by extensionists. It is remarkable that even in the case of Kalmari´s single farm, where investment could be considered rather high on average, the installed plant took 5 years of payback time.

5. Changing System of Values in transition economies

Transition to a market brings a change to institutions and instruments influencing the use and management of natural resources, and as such, biomasses for bio energy projects. Relevant mechanisms in change concern: *property rights* and ecological values in the agrarian culture; self-organisation, participation, interest harmonization among stakeholders and conflict regulation (Lütteken and Hagedorn define them *institutions of learning society*); *regional/national policy* for rural development; *international policy and institutional arrangements* (such as EU regulations, or UNFCCC CDM).

The impact of privatisation of property rights in transition (and informal) economies involve: redistribution of property rights on various component of natural resources and land (physical properties, management and land/natural resources use), therefore the question of how redistribute them among the stakeholders involved; the capacity of property rights arrangements to safeguard the natural environment and newborn economies, that depends on the reliability of the state and its authorities.

The whole system of values (economic, ecological, and managerial) undergoes radical change in different perception of present opportunities, employment of resources, expectation for the future of energy crops and woody biomass. Values are intensely rooted through experiences of tradition, or scaring socio-economic history (like experiences of people during the first decade of transformation, in former Soviet CIT[183]. Conclusions about the role of as extension services as institutional governance will be here applied to Republic of Moldova, as being characterized widely by rural economy and high energetic dependence by fossil fuel import from Russia.

The relationship between agricultural production and environmental pollution, as a pattern of development, illustrated by Lütteken and Hagedorn (1998)[184], will be here interpreted with data provided by V.Gulca[185], about perspectives of Renewable Energy as equilibrium between society, Forest and Agriculture of Moldova. CIT relationship between agricultural production (here extending to agro forestry) and pollution can be described by four periods.

[183] Countries in Transition.
[184] Lütteken, A. & Hagedorn, K. 1998. Transformation and environment: Perspectives for Central and Eastern European countries, *In* G. H. Peters, G. C. van Kooten & G. A. A. Wossink, eds. *Economics of agro-chemicals, Proceedings of a symposium of the International Association of Agricultural Economics*, Wageningen, The Netherlands, 25th-27th April 1996, Aldershot, Hampshire, Ashgate, pp. 347 – 358.
[185] Gulca, V. 2007. Personal Communication.
"Perspectives of Renewable Energy – key challenges in strengthening of equilibrium betweem society, Forest and Agriculture of Moldova", State Agricultural University of Moldova, 2007

	I) PERIOD centrally controlled production	II) PERIOD destruction of marketing channel	III) PERIOD lack of capital	IV) PERIOD new policies
inputs	+	-	-	+
environmental pollution	+	-	-	+

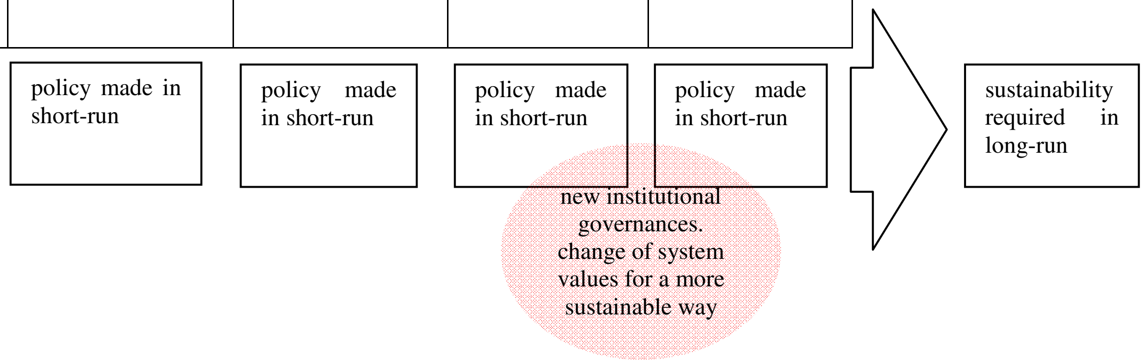

Figure 16- Changing of system of values in CIT: environmental impact of agriculture sector

Source: Author

First, "the period of the centrally planned economy as it had existed before the radical political changes occurred"[186]: centrally controlled agricultural production was characterized by subsidized inputs, resulting in a massive use and harmful application[187].

"Secondly, the time of political upheavals"[188]: destruction of economic and legislative structures caused uncertainty in agriculture; the collapse of economy and the destruction of marketing channels, both for input and outputs, reduced the pressure of environmentally polluting activities of the agricultural sector.

Thirdly, the period of transition saw an ongoing low level of the use of environmental harmful practices, due to the lack of capital. New rules for economic activities and redefinition of agricultural policies are to be established; "in this phase, internal driving forces towards sustainability as a holistic approach are more or less missing, although there may be some pressure from new environmental groups, requirements needed for future EU membership and from international agreements". Group of pressure[189] can act to make government achieve access into European orbit, and as such contribute to stimulate policy makers to organize agricultural sector in a way that makes it compatible to CAP; this motivation certainly affects environmental policies but it has to be expected that the low use of potentially harmful inputs will actually reduce the motivation to implement strong environmental regulations.

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[186] Lütteken and Hagedorn, " Concepts and Issues of Sustainability in Countries in Transition", Humboldt University, Berlin

[187] In Republic of Moldova: "Reproductive capacity of fertility and ecological quality of soils were seriously affected by big agricultural exploitations based on intensive technologies with excessive use of chemical fertilizers, pesticides and herbicides." *source:* UN, 2002. Republic of Moldova, Country Profile. Johannesburg Summit 2002.

[188] *ibid.*

[189] Such as: European Movement, "an international organisation [that benefits of the support of European Commission, working] as a study and information group, and also as a pressure group". http://www.europeanmovement.org. Moldova is among the 41 members, with a national council based in Chisinau. Preparatory Committee of the European Movement in Moldavia, Chisinau, Puskin 22 str, 515-518 of Chisinau, Moldova Republica

Fourth phase will see the restructuring of agriculture, by institutionalisation of agricultural and some environmental policies; the input-output ratio will be stabilized, by achieving a high and efficient level of input use leading again to boosted agricultural production but environmental pollution.
Sustainability is thus a long-run phenomenon that finds difficulties to be corresponded by environmental policies made in short-run, or in each of this period: perception of long-run urgency is fragmented into short-run economic and political reaction.

The period of the creation of new institutional governances for a change, thus leading to a more sustainable way of management of natural resources for bio energy (those could be combined with climate mitigation projects), can and should be collocated between the third and forth period: after the fourth period of innovation and a more stable (or maybe just more competitive) economy, it may be difficult to change the rules again in favour of the environment prevention, thus sustainability of the activities related to it (agricultural production and soil pollution, cattle production and water pollution, and so on).
Therefore, a crucial element of the transition process is the redefining of property rights, being aware that redefined property rights alone will not guarantee less contamination unless institutionalized mechanisms for controlling implementation are established. Still, sustainability to be really feasible has to integrate not only ecological or economic values, both social and political (specifically to Moldova, this is currently the most binding aspect towards sustainable practices: dependence from Russia is relevant to the sovereignty of the state).

An integrative approach to built in sustainable practices in bio energy should be consider, linking national objectives and aim of the transition process with local values from former period.
70% of rural people, about 70% of agricultural lands and a status of net importer of energy shape economic geography of Moldova. The need for a change for a more independent economy (thus sovereignty) is represented by a yearly expenditure on energy import [190]of more than 500 million USD (about the 30% of GDP)[191]; about 60% of final energy consumption is in the form of electricity and heat. Being forest and soil main resources, sustainable in time project for bio energy is an opportunity facing design geographic problems (concerning forest fragmentation, "land sliding, deficit of water, substantial reducing of soil quality

[190] "The production of electric power in 2000 constituted 904 million kWh. The share of the electric power produced in the country constituted only 26.8% of the overall volume of electric power of 3379 million kWh supplied in the network; [Total Primary Energy Supply in 2004, 3.38 Mtoe, with 0.08 Mtoe of Energy production and an energy consumption of 5.38 TWh – *IEA (2004)*].
The production of the heating constituted 3057 thousand Gcal, thus registering a lower level as compared to the previous years. These reductions were caused by the lack of fuel as well as by the longer period of warm season of year and *the incapacity of the population to pay for the consumption of the electricity and heating*." *Stressed on purpose. Source:* UN, 2002. Republic of Moldova, Country Profile. Johannesburg Summit 2002.
Main suppliers of energy sources: Russia (100%, gas); Ukraine, Russia (100%, coal).
source: Gulca, V. 2007. Personal Communication
[191] 29% of GDP in 1995 (Gulca, 2007), and 30% of GNP in 2002 (Mowry, G. 2005, "Energy Appendix" Report, in Proceeding extension cooperation to Technical University of Moldova, University of St.Thomas, St. Paul, Minnesota, USA. http://courseweb.stthomas.edu/moldova/).

and crop capacity during the last 20 years" (Gulca, 2007[192]); management problems (unsustainable use of renewable resources[193], illegal cutting[194]) and economic problems (low salaries). Fuel crisis and pastures are two additional factors degrading forest resources; as, during last 13 years almost all industrial animal complexes have been collapsed, most of domestic herbivores are in the property of population and farmer husbandry. Proportion of al domestic herbivores for agriculture enterprisers and population husbandry is 8% and 92%, and the principal causes of increasing nitrate and microbial contamination in water resources in wells[195] are related increasing of livestock breeding in inadequate household conditions[196]. Results are illegal manure place on hills, at few meters from villages.

International agencies claim the necessity of reforms in sector of energy, as well "increase the power efficiency through the promotion of a consequent policy of energy conservation, including the use of regenerating resources"[197].

Data about renewables in Moldova, IEA (2004)[198], show that there Primary Solid Biomass production (2995 TJ) is fully used only for domestic purpose (Domestic Supply 2889 TJ); no relevant electricity nor CHP plans were available, and no unit were used for energy production. The entire production of Primary Solid Biomass is used for not-specified activities (external to industrial, residential, agro-forestry consume and public services), seemingly processed in heat plants.

Gulca stresses that land users "know that from manure is possible to extract gas or that wood dust could give electricity, [but] generally most of people (especially rural) are far from this problem [...].The corner stone of the problems in relations of local people with their nature around in Moldova are feeling and educating of something private over land, keeping during a long history."

Among barriers to the use of Biomass Energy Resources in Moldova, Mowry underlines main lacks of: databases on renewable energy potential; free and easy access to existing information on local Renewable Energy; Case Study on efficiency and economic profitability in replacement of traditional cultures by modern ones; and eventually points out the low knowledge level of general population, especially rural population, on anaerobic fermentation process.

Mowry distinguishes four sub-groups of measures to promote and stimulate the usage of Renewable Energy: legislative, institutional, educational, and technological. The highlighted barriers can be addressed to institutional and educational measures, thus under a paradigm of extension, able to promote education for a change in resource use.

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[192] "The necessity to extend the forest cover as much as possible" (Gulca, 2007), met the thresholds of the discussed above CDM-project financed with World Bank's Carbon Fund (2004)

[193] Moldova benefits of rich soil but unprofitable agriculture.

[194] Reports of illegal logging for fuel wood have been increasing dramatically since 1990. Cases of illegal logging often involve entire collective farms or communes, with no possibility of identifying a specific culprit.

[195] Water from wells supplied 82% of rural population.

[196] "The pollution of agricultural lands exists although the use of chemicals per hectare reduced by 4.3 times during 1991-1998. The rate of soil biological pollution increased by 2 times due to the lack of systems to clean and use the livestock and agricultural wastes. The protection, improvement and sustainable use programmes of the soil resources can be achieved only through multifunctional environmental development tools [...]."
source: UN, 2002. Republic of Moldova, Country Profile. Johannesburg Summit 2002.

[197] *ibid.*

[198] Renewables in Moldova, Republic of in 2004, IEA. http://www.iea.org/

The followings are specifically referred to Moldova; as seen in Chapter 2, they are a general frame for CIT and Development Countries. There is a lack of data, found dispersed in several ministries, and the most critical parts of information do not exist. “It is necessary to create an agency of authority, or to charge an existing body to manage renewable resources activity, and to connect and link information concerning renewable energy. […] Lack of education policy in the field of Renewable Energy can substantial reduce or even cancel efforts developed in this sector; another educational point to be improved is the participation of the junior specialists at the development of the Renewable Resources market. Presently, specialists working in Renewable Energy sector were trained 10-20 years ago. Thus, it is necessary to prepare and train young specialists in research and development Renewable Energy activities”[199].

International cooperation could help to build develop such institution, as well through the support of not-profit organisations contributing to climb the up-front problem of a “strong lobby supporting commercial companies which import traditional fuels”[200].

Abdallah (2007) [201] draws a scheme of barriers to rural electrification from renewable energy sources available locally; figure 17) highlights were properties of extension services analysed in Finland and Sweden have been attending their historical development.

UN recognized that "the development of extension services is [thus, as in this work discussed,] essential to respond to the needs of the new private farmers. Significant steps have been taken in this direction. Several donor programmes support the development of extension services, and help to overcome an important financial bottleneck for agricultural production in supplying credits" [202]; since the former UN Country Review, 2002, thus during the passing through from third to fourth period, UN states that "extension services have developed well and are available in most of the country[203]", and that several independent organizations provide advisory and other services to the farmers". Despite this, there are still no services open specific for bio energy sector, institutes with considerable capacity for research are under severe financial constraints, lack of measure to demonstrate renewable energy perspectives (Gulca, 2007) and "a great need to develop organizations for cooperation in the marketing and processing of products." (UN, 2005).

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[199] Mowry (2005).

[200] *Ibid.*

[201] Abdallah, S. M. 2007. Rural Electrification in Kenya with Community Cooperatives Engagement. AAlborg Universitet. *In Press*

[202] UN, 2005. Environmental Performances Reviews, Republic of Moldova, Second Review. New York and Geneva, 2005.

[203] *National AGROinform Federation* unites Regional Information and Consultancy Centres with their main funding from donor projects.

AGROinform publishes manuals and brochures, and has programmes providing credits for development of marketing and storage.

National Rural Extension Service (ACSA) was formed in 2001 by partners such as the National Federation of Farmers and the Union of Association of Agricultural Producers, within the framework of a Tacis project; now funded mainly by a World Bank loan and the MoAFI.

National Federation of Farmers support the rights of the newly established farmers.

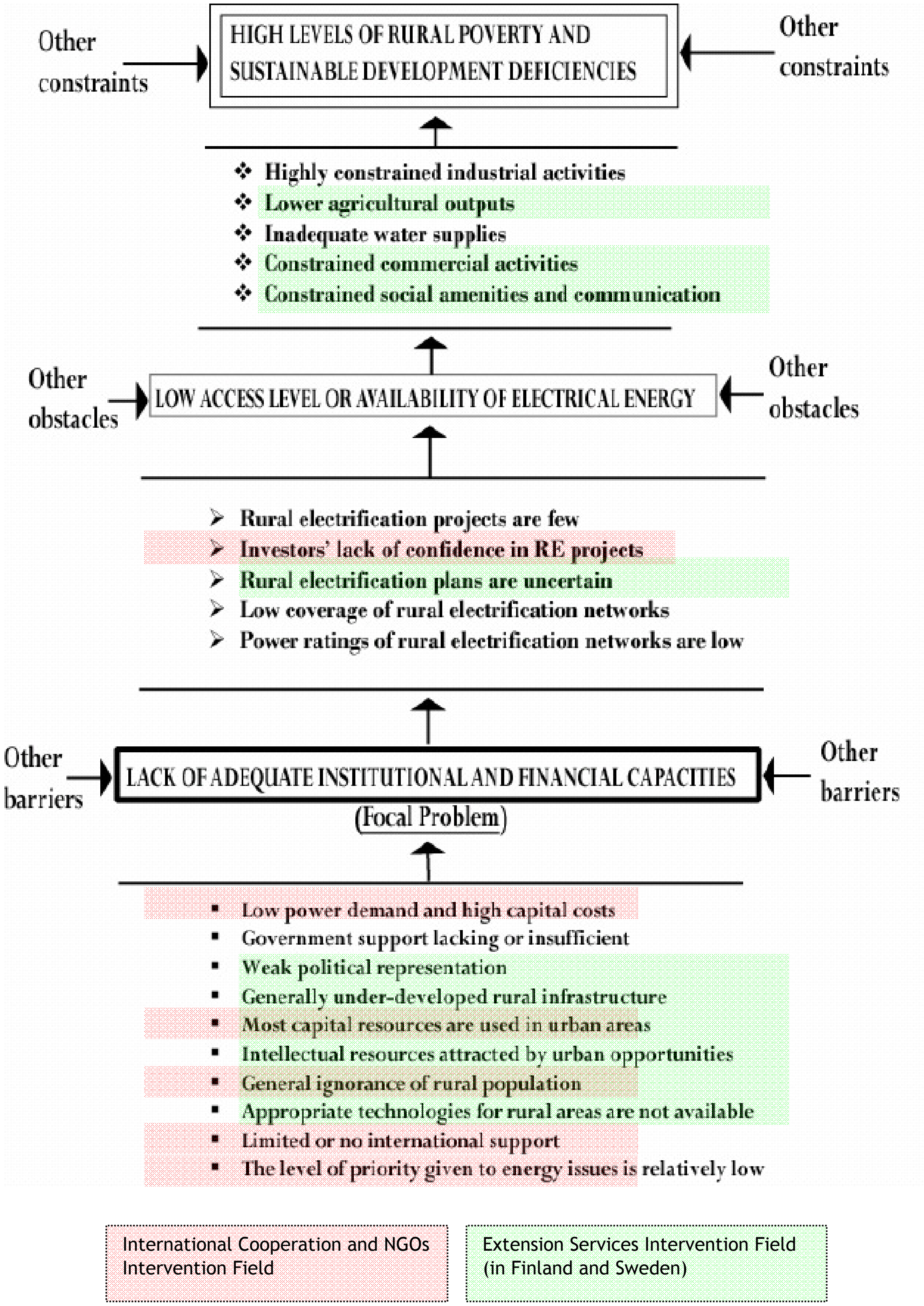

Figure 17 - Central Factors in Rural Electrification Development for poverty reduction, and areas of intervention by Extension Services (according to Finnish and Swedish) with possible interaction of NGOs and/or International Cooperation

Source: adapted from Abdallah (2007)

6. Conclusions

The development of sustainability in energy sector and biomasses is thus not rather complex. Extension services has effectively a key role for assisting change for development, via supporting new self-organised local governance institutions and acting as a reference for designing projects for a better management of forest resources, energy crops and husbandry waste.

Pattern of bio energy results are profoundly influenced by marketing prices of alternative energy sources and expectation of income, and by property rights redefinition for management of natural resources; both attributes rely on producer and consumer side. To cut-down transaction costs to design feasible projects taking into account the option of renewable resources from biomass, information dissemination and long-run assistance should be provide. Participation is the next step for transformation of system values and environmental consciousness, if able to meet economic needs of land users. Economic needs of land users regarding energy consumption, are mainly based in electricity and heating cost.

The appraisal conducted in Finland shows that small-size projects with short time of return of investment, and possibility to cut-down cost of heating and electricity, could well meet the interest of land users, as more tangible and returning quicker the investment than large scale. Designing a network as a scheme able to distribute services at cost, and uses less resources for the same output in a centralized scheme, the approach used in Finland could be further investigated in other countries, relating at local prices and conditions.

A briefly investigated dimension of network for self-consumption, sketch an hypothesis of taking into account three/four households managing together plots representing on the whole a dimension between 100 and 150 ha; the approach could be further applied to other situation, as well as Moldova, according to energy prices, size of farms, attitudes of farmers and land users, and a specific attention to property rights.

Extension services figures among best-able body to cooperate with for endorsing self-organising of institutional governance for bio energy resources.

Small-scale business organization, specializing in micro-entrepreneurship, savings, credit, and directed towards environmental protection can rise with a cooperative system structure.

Where cooperative systems face problems of elite capture or excessive control by the government (highlighted by Abdallah, 2007), extension services could contribute to a change in new institutional governance by providing education and planning in cooperative (as well private) business matters and education among co-operative members. Where excessive government control has created the impression that cooperatives are government organizations, they eventually can improve the sense of belonging to the cooperative: they can assist the change in culture of dependency, for perceived ownership of the cooperatives by the government.

Abdallah underlines that “when government control is reduced, leadership malpractices increase, and conversely strong control suppresses members’ voices; thus members are subjected to a vicious cycle”.

Through assisting in planning and information, the role of extension institution can prevent vulnerability of members to manipulation by leaders.
Extension institution can facilitate to balance a correct distribution of benefits in network among different stakeholders; as well, it can prevent risk of empowerment of few enlightened members or cooperatives, where there is a process of change in property rights or there is not equal access to education and possibilities among the community.

Networking inside CDM-thresholds could be designed on village scale, or coordinated among different cluster of households; anyway, legal aspects have still to be better defined and they pertain to upper levels in structure society respect to external services and land users.
Therefore, specifically to CDM, extension services cannot cover the role of certification body, being not a controller itself but advisory body; still, they could act as a counterpart, providing information on land use and promoting feasible practices for local rural development, thus contributing in building-up databases whereas lacking, necessary for environment design. Standard certification under CDM is currently far to be reached.

The cost of small-size combined CDM-bio energy could be consider optimistic (100÷200 €/ha) to be supported by cooperative or environmental cooperative designed under NIE principles. As such, property rights should be redesign and access to credit should be advocated; NGOs could act as partners for fundraising and micro credit financial programmes. Assistance should be provided in long-run, moreover in the first period of setting up institutional reform; linkages of good practices given by international institutions (such as FAO's IBEP) should be exploited.

Finally, it's clear that a change in property rights and land use require an institutional change from governmental or regional side. Whereas extension services are under a setting up process, NGOs can contribute to self-organising local institutional structure of governance (such as cooperative and network) in the bio energy sector; however, without a framework of a wannabe permanent, entrusted, coordinating extension services, impacts of local changes into economic feasible and more environmental friendly practices for bio energy use will likely remain tied up at local scale thresholds.

Appendix A

Kalmari self sufficient farm.

Despite EU policy support, Kalmari farm in the village of Leppävesi, 15 km from city of Jyväskylä in Central Finland is a very rare case of such a farm scale polygeneration facility. The biogas production system is a result of an individual farmer's vision and efforts facing towards Finnish political environment that, instead of granting support, maintains many barriers to such activities.

Schema

The mesophilic anaerobic fermentation reactor co-digests cow manure, food industry waste (such as Panda - sweet factory in the neighbourhood), kitchen waste and plant waste. The farm is currently self-sufficient in electricity, heat and automotive fuel.

The main feedstock for the reactor originates from 40 cows and 60 calves in an open cow house (A) where the animals are not tied but free to move around. The raw sludge is stored in a closed intermediate storage (B) facility. Bio waste storage building (C) contains waste from the local food industry (sweet factory), kitchen waste from the farm and plant waste from the farm. Cow sludge and bio waste are mixed in a 90 m3 mixer tank (D). The mixer tank is behind the bio waste storage building but is not visible in the aerial photo. The raw mixed sludge is pumped into a 150 m3

biogas reactor (E). The reactor is kept at a constant temperature of about 35 °C that is optimal for mesophilic bacteria catalysing the anaerobic digestion process that produces biogas and fermentation residue. The reactor also acts as intermediate biogas storage.

Process control and monitoring electronics as well as CHP unit and gas boiler are located in building (F) where the produced raw biogas is pumped. Hydrogen sulphide is removed from the gas biologically inside the reactor and water by absorption immediately after the reactor. The resulting gas contains about 60-65% methane and 35-40% carbon dioxide.

For automotive fuel use the biogas is upgraded by water scrubbing in a container (G) to 200 bars 98% methane. The hydraulic retention time (the average feedstock processing time) is about 20 days, after which the fermentation residue is pumped into a 1500 m3 covered residue storage tank (H). It also acts as biogas storage and a post-fermentation reactor where about 6% of the biogas is produced during an average storage time of 3 months.

Micro - CHP System

Combined Heat and Power (CHP) is an efficient way to generate electricity and heat simultaneously. The primary fuel for many CHP systems can be natural gas, clean oil, coal, biomass, solar concentrators, and hydrogen.[204]

Due to their capture of useful energy both as electricity and thermal output (heating, cooling, steam, hot water, dehumidification, etc.), CHP systems should always be able to exceed the total fuel efficiency of even the best central power plants, dividing the energy content of the fuel inputs into the delivered energy content of the total useful output, and taking average transmission and distribution line losses into account. A state-of-the-art central plant (a combined cycle combustion turbine using natural gas) offers, for delivered power, maximum system fuel efficiency in the range of 55-60%. At this efficiency level, CHP systems will effectively double the central electric system's average delivered fuel-use efficiency of about 30%. However, under common circumstances, CHP systems will achieve efficiencies exceeding 70%. CHP systems achieving efficiencies exceeding 80% are frequent, and some systems have been shown to reach levels in excess of 90%.

The micro-CHP engine used in the farm for power and heat production is a diesel engine most commonly used in Valtra tractors, optimized for raw biogas at the farm. It has 30 kWe electric power capacity and additional 60 kWt heat production capacity. A 80 kWt gas boiler is then in use. The raw biogas where hydrogen sulphide and water has been removed can be used directly in the CHP unit and the gas boiler. Carbon dioxide removal is not needed.

Electricity is used in the farm and especially during winter, when the production level is optimised by storing food industry waste for peak domestic needs. The heat produced by CHP boiler is used for hot water heating, space heating and crop drying.

Considerations

Needs and values raised in this case study are: generate economic benefits by self producing heating and electricity; environmental impact; request for a more adequate environmental polices from local farmers. Hence Kalmari´s farm represent an example against law barriers, destined not be a spot example.

Economic benefits are the self production of electricity from farm own energy resources, added now by the production of automotive fuel, but the main one comes from offsetting the farm's own energy and fertilizer costs[205]. In addition to energy self-sufficiency in other than tractor use, commercial fertilizer need has decreased by more than 60% due to the improved fertilizing effect of the fermentation residue compared to raw slurry. Electricity sales and industrial waste gate fees provide direct income. Additional income comes from substantially increased milk production resulting from improved cow health due to decreased pathogen cycling. Auxiliary benefits include positive externalities such as reduced smell.

[204] United States Combined Heat & Power Association - http://uschpa.admgt.com/techapps.htm#package
[205] Analysis of: Ari Lampinen, Renewable Energy, Education and Research Programme, University of Jyväskylä

Environmental impact. University of Jyväskylä further analysed the pathogen content of the fermentation, and compared it to the untreated cow sludge. Results were a reduction of almost 100% of pathogen bacteria[206], lower than the limits required from minced meat for human consumption.

Environmental policies impact. Rural electrification in Finland took place before the Second World War by grass-roots activity of farmers and co-operatives. The Finnish government did not support such activities in farms either financially or technically. A peculiar national problem is the powerful Finnish agricultural organization MTK[207] that has taken a stand against all other farm energy production except wood for heating-only use[13].

There are two economic instruments for renewable energy promotion: an investment subsidy of 1-40% based on subjective civil servant decisions and a small electricity tax credit of 0.25-0.69 cent/kWh[208]. The Kalmari farm was *not* granted either of those support types.

Thus Kalmari´s example has been the main driving force for changing the policy.

Parliament changed the low on electricity tax in 2002, as a compensation for granting permission for the 5th nuclear power plant; biogas based electricity was granted a 0.42 cents/kWh tax credit.

Another barrier is the automotive bio fuel use in Finland, by huge tax barriers.

In the case of Erkki Kalmari's biogas vehicle the annual extra vehicle tax was 11,000 euros, then removed in 2004. Given the fact that only biogas fuel and vehicles were fully tax exempted, not other bio fuels, is an indication that it was the Kalmari case that had driven the law change[13].

EU Regulations on Electricity Production from Renewable Energy Sources (RES)[209] are pushing towards larger scale use of automotive bio fuels and RES electricity; consistent part of the RES is owned by farms, thus one EU's target is to get them into the market[210].

The case of Kalmari´s farm shows a contrast between the interests claimed by entrepreneurship of a single farm despite guidelines of the strong farmer's lobby MTK, and independency of governmental support. This case can be thus considered interesting for:

- bottom-up raising importance in institutional, political pattern and scientific interest;

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[206] Coliform bacteria are reduced by over 99% and Faecal streptococci by almost 98%, at mesophilic process.

[207] The MTK is The Central Union of Agricultural Producers and Forest Owners (MTK). In 2005 the Central Union of Agricultural Producers and Forest Owners (MTK) had 166 500 members who are able to get in touch with a local producer association in nearly every town. Its sister organisation, SLC, has 16 500 members and operates in Swedish-speaking areas. MTK, its Swedish-speaking sister organisation SLC and Pellervo (the Confederation of Finnish Cooperatives) have a joint representative in Brussels. [http://www.mtk.fi/MTK_briefly/mtkfacts/en_GB/mtkfacts_etusivu/]

[208] Currently there are changing. There will be a fixed “good price” for biogas electricity. [*source*: Fredrik Ek, extensionist Pro Agria]

[209] For official documents about Innovation and Technological Development in Energy, see: http://ec.europa.eu/energy/res/legislation/electricity_member_states_en.htm

[210] Kalmari´s farm has been taken as example in the EU 6th research framework programme, related to the optimization of co-digestion process, automotive bio fuels, climate change mitigation, production of fertilizers, treatment methods of putrescible waste (comparison between anaerobic digestion and composting).

- implementing a cost-effective self-producing electricity and heating facility, at small scale;
- independency from economic subsidies;
- decentralized energy production competing with government owned centralized energy companies.

Appendix B

Social criteria derived from leading standard setting organisations[211]

Social Criteria regarding Project Design	**CDM PDD**	**WWF GS**	**FSC**	**CCB**	**IETA/ WB**
Prohibitions					
1) Not involving relocation of people, except on a voluntary base				x	
2) No inclusion of areas where land tenure is in dispute			x		
Process oriented conditions					
3) Clear evidence of long-term tenure and forest use rights to the land (e.g. land title, customary rights, or lease agreements) shall be demonstrated			x		
4) Local communities with legal or customary tenure or use rights shall maintain control, to the extent necessary to protect their rights or resources, over forest operations unless they delegate control with free and informed consent to other agencies			x		
5) Appropriate mechanisms shall be employed to resolve disputes over tenure claims and use rights. The circumstances and status of any outstanding disputes will be explicitly considered in the certification evaluation. Disputes of substantial magnitude involving a significant number of interests will normally disqualify an operation from being certified			x		
6) Forest management shall not threaten or diminish, either directly or indirectly, the resources or tenure rights of indigenous peoples			x		
7) Sites of special cultural, ecological, economic or religious significance to indigenous peoples shall be clearly identified in cooperation with such peoples, and recognized and protected by forest managers			x		
8) Indigenous peoples shall be compensated for the application of their traditional knowledge regarding the use of forest species or management systems in forest operations. This compensation shall be formally agreed upon with their free and informed consent before forest operations commence			x		
9) Comments by local stakeholders have been invited and compiled	x			x	x
10) Summary of comments and report on how due account was taken of any comments	x			x	x

[211] *source:* M. Dutschke *et alii*, "Risks and Chances of Combined Forestry and Biomass Projects under the Clean Development Mechanism", UNEP, CD4CDM Working Paper Series WORKING PAPER NO. 1 Revised June 2006. Annex 29, 30, 31.

Social Criteria regarding Project Design	CDM PDD	WWF GS	FSC	CCB	IETA/ WB
received					
11) Parties, stakeholders and UNFCCC accredited NGOs shall have been invited to comment on the validation requirements for minimum 30 days, and the project design document and comments have been made publicly available					x
12) Management planning and operations shall incorporate the results of evaluations of social impact. Consultations shall be maintained with people and groups directly affected by management operations			x		
13) The project proponents must use appropriate methodologies (e.g. the livelihoods framework) to estimate the net benefits which the project activities must generate on the social and economic wellbeing of communities				x	
14) Require a social impact assessment if impacts are considered significant by project participants or host country	x				
15) Project developers must make all project documentation publicly accessible at or near the project site; only withholding information when the need for confidentiality is clearly justified; informing local stakeholders how they can access the project documentation; and by making key project documents available in local or regional languages, where applicable				x	
16) Stakeholders in the project's area of influence must have an opportunity before the project design is finalized, to raise concerns about potential negative impacts, express desired outcomes and provide input on the project design				x	
17) The project proponents must include capacity building, i.e. a plan to provide orientation and training for the project's employees and relevant community members with an eye to building locally relevant skills and knowledge over time				x	
18) Existence of a formalized clear process for handling unresolved conflicts and grievances that arise during project planning and implementation. The project design must include a publicized process for hearing, responding (within 30 days) and resolving community grievance, which has to be documented				x	
19) Appropriate mechanisms shall be employed for resolving grievances and for providing fair compensation in the case of loss or damage affecting the legal or customary rights, property, resources, or livelihoods of local peoples. Measures shall be taken to avoid such loss or damage			x		

Social Criteria regarding Project Design	**CDM PDD**	**WWF GS**	**FSC**	**CCB**	**IETA/ WB**
20) The project proponents must show an early commitment to the long-term sustainability of project benefits once initial project funding expires, e.g. designing a new project that builds on initial project outcomes, securing payment for ecosystem services, promoting micro-enterprise, or establishing alliances with other organizations to continue				x	
21) The project proponents must describe who they will disseminate information on lessons leaned in order to encourage replication of successful project practices				x	
22) The monitoring plan must provide the collection and archiving of relevant data concerning social and economic impacts					x
23) The choice of indicators for sustainability development (social, economic) must be reasonable					x
24) At least two direct public consultations		x			
25) Respect and build upon the rights and needs of indigenous people and local communities				x	
26) Ensuring that the project meets the needs of local stakeholders		x		x	
27) Ensuring that the project creates other social benefits than GHG emission reductions				x	x
28) Contribution to poverty alleviation		x			
29) Contribution to improve the livelihoods of the poor: equal distribution of wealth and opportunity for disadvantaged sectors, in particular marginal or excluded social groups		x		x	
30) Improving access to essential services (water, health, education, access to facilities, etc.)		x			
31) Improving access to reliable and affordable clean energy services, especially to the poor and in rural areas		x			
32) Raising the human and institutional capacity of local people and/or communities to participate actively in social and economic development (including empowerment, education, involvement, gender)		x			
Total number of social criteria cited regarding project design	**3**	**7**	**9**	**14**	**6**

Appendix C

Questionnaire administrated to extensionists

Extensions for bio energy solution in rural areas

Questionnaire to Extension & Advisory Services

This *Questionnaire* is intended to analyse how extensions methods can contribute in bio energy solutions and opportunities, with an eye of regard for small farmers or living in remote rural areas.

It is a crucial part of the research thesis "Extension methods and bio energy" (University of Padua and University of Helsinki[212]); possibly and hopefully, this work could be useful for extensionists working with bio energy solutions.

If not possible to answer, please write the reference of person or source where to gather the data required.

You can write the answer below each question.

Many Thanks for your important contribute.

Luigi Assom

University of Padua, Italy

[212] Reference: prof. John Sumelius, john.sumelius@helsinki.fi; researcher: luigi.assom@gmail.com

About the extension service

1. What does the government or other institutions expect the extension service to do?
2. What do farmers expect the extension service to do?
3. How does the extension service connect the goals of EU/nation with what is done locally by farmers?
4. Who can be considered "Extensionist"?
5. Is the extension service in Finland an independent body? Who is it referring to? Who is funding the service?
6. Is extension service working with research centres? (e.g. University, VTT, etc.)
7. Who sets the guidelines for the extension service? Farmers or authorities? If by farmers, how much do the farmers pay?
8. How well do farmers trust the services and activities provided by the extension service?

About Expectations in bio energy

1. Who does drive Pro Agria to start with advisory activity concerning other biomass than wood?
   (such as energy crops and manure)
2. According to needs and expectations of farmers, what kind of energy crops interests the producers most?
3. About economic prospects, profitability of energy crops and wood, and potential of production: how do EU regulations and national studies match willingness of farmers?
4. EU and national goals have been set to increase the production and usage of energy crops as renewable energy sources. How does the extensions service take into account and manage the willingness of farmers to produce these?
5. According to your opinion, what is the impact of cultivation of energy plants on environment? Could you describe it?
6. Further than matching the demand of energy market: is there a perspective to make the advisory services match the goals of EU's credit carbon system (päästökauppa), or other EU polices in agriculture (such as preservation of environment and landscape)? Could you describe it?

About polices and environment

1. Do forestry planning and environmental protection processes in Finland meet the demand of wood?
   How do these tools guarantee sustainable practices for wood fuel production and consumption?
2. The Credit Carbon System (päästökauppa) is a powerful system that allows cost of emission of CO2 to be evaluated.
   How is the extension service working to develop a Credit Carbon System that could be used in agriculture, through bio energy crops?
   How could the interest in a credit carbon system be raised among farmers?

About Economic Values & Management

1. Considering the portfolio of choices that a farmer can do, how can extension support the shift into cultivation of energy crops in:
    a. risk adjustment
    b. which mechanisms of reducing risk the service is providing
    c. is the extension service collaborating with solutions taking into account communal or common participated risk?
    (e.g. supporting networks of producers)
2. Considering the uncertainty with households in cultivating energy plants, describe how extension is supporting:
    a. Experience of farmers *(e.g. contributing in sharing knowledge? how it doing that?)*
    b. Helping in planning cash-flow
    c. Planning expectations of returns *(e.g. which methods are undertaken; which is the cash flow of energy crop; prices of biomasses; ...)*
    d. Is extension service in relationship with other assets or enterprises or universities, beside farmers?
3. Which kind of *assurances* can extension services give *to reduce risk and provide adjustment strategies and abilities* in cultivating and marketing: wood fuel, reed canary grass, manure, and other forms of biomass?
4. Which kind of incentives should be given to farmers to raise their interest in energy plants?
    How could be it possible to show farmers the potentiality of bio energy solutions in short term?
5. Describe the *Role of energy plants for the income of families* (expectation of profitability depending on prices and dimension of farm), concerning:
    a. wood
    b. reed canary grass
    c. manure
6. About *Economic values* of biomass, what is the value of:
    a. wood
    b. reed canary grass
    c. manure

About Agricultural Management

1. How do energy crops depend on season? (wood, reed canary grass, manure, other)
    How many tons/ha or m3/year one can expect to harvest or obtain?
    Is the extension service advising on this?
2. How can the cultivation of energy crops affect the nourishment to soil and improve/reduce the risk of impoverishment?
3. Is the extension service considering the impact of production of energy crops on the nutritional state of the fields? How is the service advising on this? *(e.g. with magazines, consulting, common data plots,)*

About Networking and Cut-down opportunities for small farmers / remote rural areas.

1. Does the Extension service advice small producers of mixed biomass sources (wood, manure, reed canary grass) to cooperate among them, in order to share benefits and cut-down cost?
   How and with which methods, if not describe why.
2. Which kind of variable costs could farmers cut-down, by cultivating bio energy crops in cooperation among them?
3. Which kind of cooperative network could be set up[213]?
   Please report your ideas and motivate them, or otherwise report some existing case history.
4. Could you quote any feasibility study plans for existing networking cooperative?
   (Possibly based on small-medium farm investing in energy plants).
   Data could report: 1. average dimension of producers; 2. gender and age (attitudes); 3. Amount produced/year; 4. Benefits in income; 5. Benefit in cut-down costs analysis.
5. How do energy crops depend on labour or management on the field?
6. Are there specialized markets in Finland for different sectors of bio energy? *(e.g. market for bio diesel, biogas, other).* How are they responding to price variation in time?
7. Which are the features of these markets?
   - Dimension of producers *(e.g. average dimension of farm or average production of biomass, considering wood, reed canary grass, manure, others)*
   - Are there stable prices (availability of trend and previsions?)
   - If there are, how much do subsidies affect them?
   - Who are the buyers and sellers?
   - Do cooperatives or network of small producers of biomass exist?
     Cooperatives can be for sharing benefits and cut-down cost?
   - How is the extension service supporting the cooperatives/networks?

[213] *example*: some ideas about: (*objective)*: Sharing incomes production and/or sharing cost of processing biomasses; (*management)*: fee on use of consumed energy *or* by dimension of farm *or* by quantity of biomass provided.

Some Useful Values and Information for networks

1. About *Wood fuel* use for energy purposes in Finland:
    a. m3/ha that a small/average farm can produce yearly
    b. do you that fuel wood could be used by farmers for other purposes than heating only?
    c. do you think fuel wood could be processed in a plant operated/owned by a network of producers? *(e.g. in central plant or self-in-farm or sold to market ...)*
    d. if so, how big do you think the dimension of the network could be? (considering dimension of farms and numbers of farms)
    e. considering small/medium farms (<100 ha), how big is the consumption of fuel wood per farm? (in cubic meters or tons)

2. About the use of *Reed Canary Grass* (ruokohelpi) in Finland:
    a. use *(e.g. heating, electrification, sold to market)*
    b. is the willingness rising even among small/medium farmers to produce it?
    c. do you think reed canary grass could be processed in a plant operated/owned by a network of producers? *(e.g. in central plant or self-in-farm or sold to market ...)*
    d. if so, how big do you think the dimension of the network could be? (considering dimension of farms and numbers of farms)
    e. considering small/medium farms (<100 ha), how big is the production of reed canary grass per farm?

3. About *Manure* use for energy purposes in Finland:
    a. average dimension of bio gas plants
    b. do you think manure could be processed in a plant operated/owned by a network of producers? *(e.g. in central plant or self-in-farm or sold to market ...)*
    c. if so, how big do you think the dimension of the network could be? (considering dimension of farms and numbers of farms)

References

Bibliography

1. Abdallah, S. M. 2007. Rural Electrification in Kenya with Community Cooperatives Engagement. AAlborg Universitet. *In Press*
2. Abrahammson, K. V. 1997. Paradigms of sustainability. In S. Sörlin, ed. The road towards sustainability. A historical perspective. A sustainable Baltic Region. The Baltic University programme, Uppsalla University, pp. 30-35.
3. Amous, S. *1999.* The role of wood energy in Africa. Series: Wood Energy Today for Tomorrow. FAO
4. Barzel, 1989. Economic Analysis of Property Rights, Cambridge University press, p.115
5. Birner, R. *et alii*, 2002. Coping with co-management: a Framework for Analysing the Co-operation between State and Farmers´ Organisations in Protected Area Management", *in* K. Hagedorn, Environmental Co-operation and Institutional Change, EE.
6. Black Sea Regional Energy Centre (BSREC). 2006. Acceleration of the cost-competitive Biomass use for energy purposes in the Western Balkan Countries. Specific Support Action, INCO-CT2005-015139. Accent.
7. Borrini-Fyerabend (1996, pp. 3, 12) *in* Birner R. *et alii*, (2002).
8. CDM - Executive Board, EB 22 Report Annex 16 page 1. Procedures to define the Eligibility of Lands for Afforestation and Reforestation Projects Activities
9. Cramer, G.L; Jensen, C. W.; Southgate, D.D.Jr.1997. Agricultural Economics and Agribusiness, Seventh Edition, Wiley
10. Dutschke, M. *et alii*, 2006. Risks and Chances of Combined Forestry and Biomass Projects under the Clean Development Mechanism, UNEP, CD4CDM Working Paper Series WORKING PAPER NO. 1 Revised June 2006
11. ECE/FAO, 1996. European Timber Trends and Prospects: Into the 21st Century. Series title: Forestry Sector Outlook Studies - ECE/TIM/SP/11
12. Engelhard, R. 1992. Wood Energy Policy Development: Lesson from Kenya. *in* P.Nemetz, Emerging issues in Forest Policy, UBC Press Vancouver
13. Enquete-Kommission. 1998. Schutz des Menschen und der Umwelt*. [in English, Protection of Man and Environment.. In Proceedings* Conference. Deutschen Bundestages, Konzept Nachhaltigkeit: Leitbild zur Umsetzung (Abschlußbericht).
14. Ferrero-Waldner, B. Strasbourg, 25 October 2006. ‘Frozen Conflicts’: Transnistria, South-Ossetia, and the Russian-Georgian dispute. *In Proceedings* European Parliament Plenary, Strasbourg. SPEECH/06/629
15. FAO, 2006. Introducing International bio energy platform (IBEP)
16. FAO, COMMITTEE ON AGRICULTURE, 2005. Bio energy. COAG/2005/7
17. FAO-RWEDP. Regional Wood Energy Development Programme in Asia. www.rwedp.org/
18. Hagerdorn, K.; Arzt, K.; Peters, U. 2002. Theoretical Approaches and Institutional Foundation of Environmental Co-operation, *in* K. Hagedorn, 2002, Environmental Co-operation and Institutional Change, EE.
19. Hanna, 1998. Co-Management in small scale fisheries: creating effective links among stakeholders, In Proceedings Plenary Presentation at International CBNRM Workshop
20. Hazell, Pachauri. Bio energy and Agriculture, IFPRI 2020 Focus n. 14;

21. Hektor, B., 1992, 1996 revised *in* Van den Broek, R. 1997 The role of wood energy in Europe and OECD. FAO
22. Hillring, B. , "Trends and Market Effects of Wood Energy Policies", Department of Bio energy, Swedish University of Agricultural Sciences
23. HM Treasury, 2007. Stern Review on the economics of climate change, p. 227
24. Lütteken, A. & Hagedorn, K. 1998. Transformation and environment: Perspectives for Central and Eastern European countries, *In* G. H. Peters, G. C. van Kooten & G. A. A. Wossink, eds. *Economics of agro-chemicals, Proceedings of a symposium of the International Association of Agricultural Economics*, Wageningen, The Netherlands, 25th-27th April 1996, Aldershot, Hampshire, Ashgate, pp. 347 – 358.
25. Mazé A. *et alii,* "The Governance of Quality and Environmental Management Systems in Agriculture: Research Issues and New Challenges", *in K. Hagedorn, 2002-* Environmental Cooperation and Institutional Change, EE
26. McCormick, K. 2005. Sustainable Bio energy Systems: Experiences from Sweden. Brennan
27. Meinzein-Dick, Di Gregorio. Collective Action and Property Rights for Sustainable Development, IFPRI 2020 Focus n. 11
28. OECD, 1998. Co-operative Approaches to Sustainable Agriculture.
29. Polman N.B.P, Slangen L.H.G."Self-organising and self-governing of Environmental Co-operatives: Design Principles", *in* "Environmental Co-operation and Institutional Change", EE.
30. Ramsey, W. 1985. Bio energy and economic development. Planning for biomass energy programs in the third world. Westview Press, Energy Policy Series, Vol. I. No. 1
31. Slangen, L.H.G.; Polman, N.B.P. 2002. Environmental Co-operatives: a New Institutional Arrangement of Farmers, *in* Hagedorn, 2002. Environmental Co-operation and Institutional Change, EE.
32. Turner, Taylor, 2003. Applied farm management. Second Edition, Blackwell Science.
33. UN, 2002. Republic of Moldova, Country Profile. Johannesburg Summit 2002.
34. UN, 2005. Environmental Performances Reviews, Republic of Moldova, Second Review. New York and Geneva, 2005.
35. UN, ECE/TIM/SP/11. European Timber Trends and Prospects: into the 21st Century.
36. UNEP, Issued Based Modules Projects.
37. Van den Broek, *R.* 1997. The role of wood energy in Europe and OECD countries. FAO
38. Williamson, Oliver E., 1996. The Mechanisms of Governance. Oxford, UK, Oxford University Press.
39. World Bank (1996), "The World Bank Participation Sourcebook", Washington, DC: The World Bank.

Reviews and Articles

1. Bioenergiaa pellolta, January 2007 - maa- ja metsätilan omistajien halukkuus viljellä peltobiomassaa. (N.88) [*in English,* Bio energy from the field, January 2007 - Farm and forest estate owners willingness to cultivate field biomass (N. 88)]
2. Biopact Team, March 23, 2007. Crisis in European biodiesel industry, as Brazil and Argentina produce at full capacity. Biopact Archive.
   see: http://biopact.com/2007/03/crisis-in-european-biodiesel-industry.html
3. Bruckmeier, K.; Ellegård, A.; Píriz, L. 2005. Fishermen's Interests and Cooperation: Preconditions for Joint Management of Swedish Coastal Fisheries. AMBIO: A Journal of the Human Environment, Vol. 34, No. 2, 5 - Royal Swedish Academy of Sciences
4. Corriere della Sera, Economia e Finanza. May, 16, 2007. UE chiede a Italia taglio emissioni CO2 [*in English: EU demands Italy cut-off CO2 emissions]*. Corriere della Sera.
   see: http://www.corriere.it/Primo_Piano/Economia/2007/05_Maggio/15/emissioni_kyoto.shtml
5. Dornburg, V. *et alii,* Comparing the Land Requirements, Energy Savings, and Greenhouse Gas Emissions Reduction of Bio based Polymers and Bio energy, Journal of Industrial Ecology, 2004, Volume 7, Number 3-4
6. Harvey, F. February 7, 2007. *Billion lost in Kyoto carbon trade loophole*, Financial Times
7. Kenya Times, 2006. Depletion of forest cover now alarming. Session Editorials.
   see: http://www.timesnews.co.ke/05sep06/editorials/edtorial1.html
8. Mead, D. 2006. Forests for Energy and the Role of Planted Trees, Critical Reviews in Plant Sciences, Volume 26 Issue I.
9. NewScientist.com news service, February 7, 2007. Kyoto Protocol 'loophole' has cost $6 billion, New Scientist Environment and Reuters.
   see: http://environment.newscientist.com/
10. Nyberg, J. 2006. Global Bio energy Partnership. Bio fuel in Africa -Risk and Opportunities: Food, Feed or Fuel? FAO, Commodities and Trade Divisions. Sixth Meeting of Global Forum on Sustainable Energy (GFSE), Vienna, 2006.
11. Patzek, T. W.; Pimentel, D. 2007. Thermodynamics of Energy Production from Biomass", Critical Reviews *in* Plant Sciences Volume 26, Issue 1
12. project "*Accelerating the cost-competitive biomass use for energy purposes in the Western Balkan Countries*", funded by the European Commission under Sixth Framework Programme 2002-2006, *call* FP6-2002-INCO-WBC/SSA-3
13. Ravindranath, N.H. *et alii,* 2004. Sustainable biomass power for rural India: Case study of biomass gasifier for village electrification. Current Science, Vol. 87 N.7. 10 October 2004.
14. Smith, January 29, 2007. Lost in the Forest. Time. 2007

Webography

1. Belgrade report. 2007. Achieving sustainable use - forestry and agriculture.
   http://belgrade-consultation.ewindows.eu.org
2. CGIAR. 2007. Searches through the CGIAR web site and a host of related CGIAR sites.
   http://search.cgiar.org/search_form.asp
3. ESSOR. 2007. Associatión de solidarité internationale
   http://www.cyo.com/essor/index.html
4. EU Forest Watch, 2005. Issue 97.
   http://www.fern.org/pubs/fw/FW970705.htm
5. EURACTIV, 2007.
   http://www.euractiv.com/en/environment/sustainable-chemistry/article-139332
6. European Zer-Ind Consortium, 2006. Zero Emission Research and Indicators for Integrated Sustainability Assessment.
   http://www.chim.unisi.it/zerind/
7. Global Environmental Governance, 2007. Frequently Asked Questions(FAQ's) about CDM.
   http://www.cseindia.org/programme/geg/cdm_faq.htm#cer
8. Global Policy Forum, Archives, 1998, 2007
   http://www.globalpolicy.org/socecon/glotax/carbon/index.htm
9. HSBC, 2007. What you can do. Session Environment.
   http://www.hsbccommittochange.com/environment/what-you-can-do/carbon-dioxide/index.aspx
10. HUSH, Rural Agricultural Societies. 2007.
    http://www.hush.se/
11. IAMA, International Food and Agribusiness Management Association. 1999.
    http://www.ifama.org/
12. Innovation and Technological Development in Energy
    http://ec.europa.eu/energy/res/legislation/electricity_member_states_en.htm
13. International Food Policy Research Institute, "2020 Visions" and "Publications".
    www.ifpri.org
14. International Society for New Institutional Economics, 2007.
    http://www.isnie.org/
15. MTK, The Central Union of Agricultural Producers and Forest Owners. 2007.
    http://www.mtk.fi/MTK_briefly/mtkfacts/en_GB/mtkfacts_etusivu
16. The World Bank. 2007. Moldova.
    http://www.worldbank.org.md/
17. UNEP, 2007. Issue Based Modules for coherent implementation of biodiversity conventions.
    Home » Agreements » Global » United Nations Framework Convention on Climate Change (UNFCCC) » Decisions » COP 9
    http://svs-unepibmdb.net/?q=node/432&PHPSESSID=41ea3e1ad13d5a68b32e4cd9afffdd3e
18. United Nations Framework Convention on Climate Change, 2007. CDM Session.
    http://cdm.unfccc.int/Issuance/index.html

19. VTT, 2006.
http://www.vtt.fi
20. WTRG Economics, 2005. Oil Price History.
http://www.wtrg.com/prices.htm
21. Pro Agria, 2007.
http://www.proagria.fi/english/